NONRESIDENTIAL REMODELING AND RENOVATION STUDY

Quantitative Survey Report

February 2002

Prepared for:

California Energy Commission
Contract No. 300-99-016

Prepared by:

ADM Associates, Inc.
TecMRKT Work LLC

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1. INTRODUCTION

This report presents and discusses the results of the quantitative survey research for the Nonresidential Remodeling and Renovation (NRRR) Study. The overall purpose of the NRRR Study is 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 will be used in evaluating energy efficiency market transformation efforts and the effectiveness of individual programs and in strategic planning efforts.

The major question underlying the NRRR study is 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 question, the NRRR Study has four major goals:

- 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 create a research plan to enable programs that better target their markets; and
- To develop new strategies and program designs to promote market transformation.

This Quantitative Survey Report provides data that addresses these various objectives in quantitative fashion. A complementary report addresses the objectives in qualitative fashion, drawing on results from a series of focus groups.

This report is organized as follows.

- Chapter 2 reviews previous work on the subject of remodeling and renovating of nonresidential buildings.
- Chapter 3 provides a statewide review and analysis of aggregate data on nonresidential remodeling and renovation activity.

- Chapter 4 discusses an analysis of the relationship of nonresidential remodeling and renovating activity to electricity use.
- Chapter 5 discusses remodeling and renovating activity in California by geographic area.
- Chapter 6 provides data on the characteristics of nonresidential buildings undergoing remodeling or renovation.
- Chapter 7 presents and discusses survey data regarding factors influencing energy-related decisions on nonresidential remodeling and renovation projects.
- Chapter 8 provides tabulations of survey data showing the characteristics of energy-related technologies installed during remodeling and renovating of nonresidential buildings.
- Chapter 9 summarizes the conclusions from the various analyses.
- Appendix A describes the data collection methodology.
- Appendix B provides copies of the data collection forms.
- Appendix C provides a listing of places issuing permits for nonresidential alterations and additions during 2000, ranked by value of permits issued.

2. SETTING THE STAGE

This chapter "sets the stage" for the discussions in subsequent chapters; it provides information that is background for the analyses reported in those chapters. Topics discussed here include the following:

- Comparing definitions for types of construction activities;
- Reviewing previous empirical work pertaining to the remodeling and renovating of nonresidential buildings;
- Identifying market players; and
- Reviewing the decision-making context for construction activities that affect nonresidential buildings.

The chapter then concludes with a section that sets out questions that have guided the research reported on in the following chapters.

2.1 DEFINING THE TYPES OF CONSTRUCTION ACTIVITIES

Different types of construction activities occur as a building moves through its life cycle. This life cycle of course begins with new construction, 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 this 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 has shown that definitions for these construction activities have been developed from three different perspectives.

- from the perspective of designing energy efficiency programs;
- from the perspective of complying with Title 24 energy efficiency standards; and
- from the perspective of building permitting.

How construction activities for existing buildings are defined from these different perspectives and the concordance among these definitions are discussed in this section.

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

The types of construction that are the subject of this report occur with an existing building. 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]

This taxonomy of activities developed by Golove and Eto was drawn on in the work of the California Board for Energy Efficiency (CBEE) in developing a market segmentation scheme for designing energy efficiency programs. In this work, 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.

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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.

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 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

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

[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.

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.

As noted in the focus group discussions, a change in an existing nonresidential buildings 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 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.
- 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 is presented in Chapter 5 that 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 in its reports 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).

2.1.4 Implications of Different Definitions of Construction Activities

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). 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.

A difficulty arises with the different terminology with respect to the data used to measure the different types of construction activity.

For one example, as discussed below, the Construction Industry Research Board is a major source of data, both over time and between geographical locales, on permitting activity for nonresidential construction in California. 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. In its reporting, however, CIRB combines data on additions with data on alterations; it does not report separate data on the two types of activity. 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 is aggregated across the two types of construction activity because those data are provided to it in aggregated form from local jurisdictions that are following the structure coding 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. As the case studies presented in Chapter 6 will show, the classifications used to describe construction activity by local building departments 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.

F. W. Dodge also reports on remodeling and renovation activity for nonresidential buildings and separates such activity from additions. However, Dodge reports on alterations and additions only for projects considered major. A major renovation project is defined to be one where three or more alterations are made on one structure.

Because several different sources of data are used in this report in studying the nonresidential remodeling and renovating market, the terminology used in

different chapters to refer to such 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.

2.2 REVIEW OF EMPIRICAL WORK ON R&R ACTIVITY

In a study on changes in construction markets that was published in 1996[6], 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 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.

Data from federal government surveys provided the evidence for this projection, particularly data collected by the U.S. Bureau of the Census in the *Annual Capital Expenditures Survey* (ACES). In the surveys for 1994 and 1998, data were collected on capital expenditures both for new construction and for remodeling/renovating of various types of nonresidential buildings.

The ACES provides nationwide evidence of the importance of capital expenditures made for the remodeling and renovating 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 2-1.

- The highest absolute amount of expenditures on remodeling and renovating is made 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

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

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.

Table 2-1. 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%
Preschool 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%

Because remodeling and renovation can affect the effective useful life of energy conservation measures, several studies of measure lives addressed the question of business turnover and remodeling and renovation.

- In a study for the Bonneville Power Administration (BPA), Skumatz et al.[7] found turnover rates of 25% or more for small offices, small retail, and fast food sites; they also found that malls, hospitals, grocery stores, and schools are businesses that tend not to turn over.

[7] Skumatz, L., K. Lorberau, R. Moe, R. Bordner and R. Chandler, *Bonneville Measure Life Study: Effect of Commercial Building Changes on Energy Using Equipment,*. Prepared for Bonneville Power Administration by Synergic Resources Corporation, 1991.

- In a subsequent study for BPA, Skumatz and Hickman[8] found that 40% of buildings retrofitted with energy conservation measures remodeled, renovated, or turned over within two years of installing the measure. The study found that renovations and remodels in commercial buildings virtually always affect lighting systems.
- In a study for Long Island Lighting, Velcenbach and Parker[9] (1993) found a range of turnover rates from 17% for supermarkets to 3% for large office buildings and retail stores, and with an average of 5% for all business types.
- In a study for Pacific Gas and Electric, Galawish et al.[10] (1995) found that business turnover was lower among participants in PG&E's DSM programs than among the general population of PG&E's commercial customers.

A study by Deloitte and Touche (D&T) provides further evidence on when most of the remodeling and renovating effort takes place. D&T used a database of properties owned by real estate investment trusts (REITs) in 1999 to develop information on the age of structures at the time major renovations or expansions were undertaken. For each property, information was available in the database on the year of construction of the structure, as well as the years in which the last expansion and the last renovation were performed. Thus, D&T was able to calculate the percentage of structures of any age that had ever had an expansion or renovation.

Table 2-2 reports the D&T results showing the share of properties in different age groups that were upgraded, by type of building. With the exception of retail properties, major improvements are limited during the first decade of a building's life. Moreover, the profiles differ significantly among building types. Half of the retail buildings over 20 years old have had some improvement, about 38 percent of the office buildings, but only 17 percent of industrial buildings.

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[8] Skumatz, L. and C. Hickman, "Measure Life Study: The Effect of Commercial Building Changes on Energy Using Equipment." *ACEEE Summer Study on Energy Efficiency in Buildings* . Vol. 3:3.281-3.292. Washington, DC: American Council for an Energy Efficient Economy, 1992.

[9] Velcenbach, P. and L. Parker, "Can DSM Survive Persistence?" *Proceedings International Energy Program Evaluation Conference,* 1993.

[10] Galawish, E., R. Flood, L. Owashi, M. Rufo, "PG&E's Non-Residential Program: Are the Measures Still There?" *Proceedings International Energy Program Evaluation Conference,* 1995.

Table 2-2. Frequency of Major Improvements by Building Age (Properties with Improvements as Share of Age Group Total)

Building Type	Age Group for Buildings					
	2-5	6-10	11-15	16-20	21+	All Age Groups
Industrial	6%	4%	3%	5%	17%	8%
Office	0%	4%	10%	19%	38%	14%
Retail	12%	21%	18%	29%	50%	28%

Note: "Major Improvements" represent either renovations or expansions of the properties.
Source: Deloitte & Touche LLP, "Analysis of the Economic and Tax Depreciation of Structures", Washington, D.C., June 2000..

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 2-3 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. As with the nationwide statistics reported in Table 2-1, the bulk of the value of construction for alterations and additions to nonresidential buildings in California was associated with office buildings and retail stores (which are included in other commercial buildings in the Census of Construction data).

Table 2-3. 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%

2.3 MARKET PLAYERS

In a recent report on the building of new commercial buildings, Lutzenhiser et al.[11] 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
- Users.

Further qualitative information on the construction market as it pertains to remodeling and renovating of nonresidential buildings was gathered through a series of focus groups that were conducted throughout California.[12] These focus groups showed that although many of the same types of players are involved in remodeling and renovating as are involved in new construction, the key players vary depending on the situation.

In replacement situations, owners or building managers significantly influence equipment choices and design decisions. Developers and commercial property owners are arrayed along a continuum from developer/owners who buy /renovate/sell properties to developer/owners who buy, renovate and hold.

- 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.

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

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

- Owners are much like developers who buy and hold and they can be encouraged to make energy efficient investments.
- 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.
- 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.

Of the commercial space that is the target for remodeling/renovating activities, some is owner-occupied and some is non-owner-occupied or income property. The percentage of building space that is non-owner-occupied varies by building use. Office and retail spaces have larger percentages of leased space than the commercial building sector as a whole. Office and retail spaces also tend to have higher energy intensities (i.e., more energy use per square foot per year) than other commercial building uses. Moreover, as shown above, offices and retail stores are the building types where considerable remodeling and renovating activity occurs.

2.4 REVIEW OF DECISION MAKING CONTEXT

There is considerable literature examining the market for new commercial buildings. This literature addresses many aspects of that market, including the factors underlying decisions to construct new commercial buildings. Much of the recent literature on such decision making is based on the "real options" approach.

Real options refers to the value inherent in a physical asset that is derived from some future contingent decision. Real options theory is based on the observation that an asset owner has a right—but not an obligation—to make a decision or set of decisions in the future that can affect the cash flows of the asset. In particular, real options theory emphasizes the fact that, when irreversible real investments can be delayed, the "option" to delay may be valuable. The optimal timing of investment depends on the evolution of the real option value over time. Under quite general conditions, investment will be optimal as soon as the value of the option falls to zero, but not before then.

While the real options theory has been applied empirically to explain new construction of commercial buildings[13], it has also been applied theoretically to explain renovation or redevelopment of commercial properties. Williams[14] and Wong and Norman[15] present theoretical models pertaining to the optimal patterns of renovating commercial properties. These theoretical articles build on the fact that commercial buildings are real assets that can be redeveloped, remodeled, or renovated repeatedly.

Williams summarizes the results of his analysis as follows:

> "The value of a representative real asset is determined by two variables: the current price of its rental services and the current quality of the real asset. Redevelopment optimally occurs when the current quality hits a lower bound that depends on the current rent. The asset is then demolished and redeveloped to a higher quality that is determined optimally, conditional on the current rent. Relative to the solution with only one possible redevelopment, the solution with repeated redevelopment has the following properties. Development occurs sooner on average before depreciation has so severely diminished the asset's quality. Also, its quality is improved less during each redevelopment. Not surprisingly, multiple redevelopments raise the present value of the asset or, equivalently, the value of the option to redevelop. Thereby, the ratio of rent to price is reduced.
>
> …
>
> Redevelopment has two types of costs: the explicit cost of demolition and reconstruction and, with a restriction on the number of redevelopments, the implicit cost or shadow price of the constraint on subsequent redevelopment. With repeated or unrestricted redevelopment, each redevelopment is then less costly than the single redevelopment when subsequent redevelopment is precluded. If the cost of redevelopment is reduced, then the option to redevelop is exercised more frequently and less extensively each time. This is implemented by initiating redevelopment at a higher quality of the asset and improving the asset less during each redevelopment. Also, without a constraint on redevelopments, the option

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[13] Sivitanidou, Reva and Sivitanides, Petros, "Does the Theory of Irreversible Investments Help Explain Movements in Office-Commercial Construction?", *Real Estate Economics*, Vol. 28, 2000, pp. 623-661.

[14] Williams, Joseph T., "Redevelopment of Real Assets", *Real Estate Economics*, Vol. 25, 1997, pp. 387-407.

[15] Wong, K.C. and Norman, George, "The Optimal Time of Renovating a Mall", *The Journal of Real Estate Economics*, Vol. 9, 1994, pp. 33-47.

> to redevelop repeatedly is more valuable than the option to redevelop only once. Thereby, repeated redevelopment adds value to the asset."[16]

A review of these theoretical studies indicates that they have not explicitly addressed the role that tenants play in influencing remodeling or renovation decisions. As noted above, there is considerable commercial space that is not occupied by the building owner but is leased to tenants. Indeed, many small firms do not own their own buildings or space but rather are tenants in buildings owned by others. Many remodeling/renovating projects occur when a small business firm moves to a different space.

The decisions regarding installation of energy efficient lighting or equipment as part of the tenant improvements will depend on the terms of the lease negotiated between tenant and landlord. The importance of lease arrangements for improving energy efficiency in tenant spaces has been recognized by the U. S. Environmental Protection Agency (EPA). As part of the *Lighting Upgrade Manual* for its Green Lights Program, EPA included a detailed appendix for *Upgrading Tenant Spaces.*[17] This appendix provides principles and practical guidelines for renegotiating leases to enable both tenants and landlords to gain the financial and qualitative benefits of energy-efficient lighting.

Traditionally, tenant improvement projects have been undertaken by the landlord, with a budget for tenant improvements factored into the lease negotiation. The budget may or may not include design fees, but physical improvements are provided by the landlord. While this method can streamline the process for small projects, the tenant does give up some measure of control and accountability. In recent years, some tenants have decided to build the tenant improvements themselves, with a tenant allowance from the landlord.

In either landlord-build or tenant-build, lighting and other equipment is installed according to the decisions made by either a landlord or a tenant. A landlord's primary concerns are economic, including minimizing leasehold improvement expenditures, receiving rent at the earliest possible date, and maximizing the return on the leasehold improvement investment. While a tenant wants the leasehold improvements to conform to his specifications and particular business needs, minimizing the cost for leasehold improvements are also important.

Thus, both landlords and tenants face barriers that constrain them from going to higher efficiency lighting and equipment when space is remodeled or renovated.

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[16] Williams, *op. cit.*

[17] U. S. Environmental Protection Agency, Green Lights Program, *Lighting Upgrade Manual, Appendix: Upgrading Tenant Spaces,* 1994.

- Building owners/landlords prefer to minimize their renovation/tenant improvement costs. The lower the cost of improvements, the lower the rent that they can charge and the more attractive their buildings are to potential tenants. Therefore, higher costs that might result from installing higher efficiency lighting or equipment that does not provide easily understood benefits is not acceptable to owners/landlords.
- Potential tenants also prefer to minimize the amount that they pay in rent. It is true that high efficiency lighting would lower their monthly electric bills. However, if the payback period for installing higher efficiency lighting or equipment is longer than the period of their lease, they would be paying more in total each month (in that the increase in rent would exceed the reduction in electric payments).

2.5 RESEARCH QUESTIONS

The preceding discussion has been intended to show the broad outlines of the market for remodeling and renovating nonresidential buildings based on previous studies and national data and to thereby set the stage for the analyses presented in following chapters. The following chapters expand on this previous work and define in greater detail the dimensions of the market for remodeling and renovating of nonresidential buildings in California. The discussion in these succeeding chapters is organized around addressing research questions that pertain to both the macro and the micro environments in which remodeling or renovating of nonresidential buildings occurs.

One set of research questions pertains to the macro environment regarding the remodeling or renovating of nonresidential buildings in California. Aggregate data on remodeling and renovating activity for different geographic areas and different building types are used to address the following macro-level research questions.

- How much remodeling and renovating activity occurs for nonresidential buildings in California? How has nonresidential remodeling and renovating activity trended over time?
- How big is the overall market for the remodeling or renovating of nonresidential buildings? How big are different segments of this market, as defined by geographic areas and/or by types of buildings?
- What has been the relationship of remodeling and renovating activity for nonresidential buildings to the new construction of nonresidential buildings? Are the factors that determine remodeling and renovating activity the same as those that determine new construction activity?
- What effect has remodeling and renovating activity had on electricity use?

A second set of research questions pertains to the micro environment for remodeling and renovating activity. Survey data and data from Title 24 documentation are used to address micro-level research questions regarding the factors that drive remodeling or renovating decisions for particular nonresidential buildings. The micro-level research questions that are addressed include the following.

- What type of firms are responsible for the remodeling and renovation of a building? What are the investment strategies of those firms?
- Who are the key decision-makers for remodeling and renovation projects? Do key decision makers differ by type of firm or type of building?
- How extensive is the remodeling activity for a particular building? What systems are influenced by the remodeling? Does building occupancy change because of the remodeling or renovating?
- What criteria are use in making the decisions to change the energy-using equipment in a building (e.g., for lighting and HVAC systems)? For example, are there rules of thumb for replacing major systems? Are there maximum payback periods that are expected? Do the criteria vary by who makes the decision? By the size of the project? How do incentives, financing arrangements, or rebates affect decisions on changing energy-using equipment?
- For changes to the lighting and HVAC systems, who supplies information about efficient equipment? How efficient is the lighting and HVAC equipment that is installed when changes are made? What barriers constrain investments in energy efficient equipment?
- Is "value engineering" done during the course of a project? What systems are subject to "value engineering?" If lighting and HVAC systems are subject to value engineering, is it likely that "value engineering" reduces the energy efficiency of the building?

3. REVIEW OF AGGREGATE DATA ON NONRESIDENTIAL REMODELING AND RENOVATION: STATEWIDE TRENDS

Extant aggregate data, data being collected in concurrent studies, and qualitative information on remodeling and renovating activity for nonresidential buildings are reviewed in this chapter to delineate trends in the nonresidential remodeling and renovating market in California.

3.1 PRIMARY DATA SOURCES

Data collected for the *1999 State-Level Small/Medium Nonresidential MA&E Study*[1] showed that early replacement and remodeling/renovations were the key market events occurring in the Express Efficiency Program. Xenergy/Quantum found in their study that three-fourths of customers participating in the Express Efficiency Program said they had used the program to replace fully functional equipment. Remodeling appeared to be a key market event; lighting and HVAC installations were included in remodels at about two to three times the baseline rate. The study also produced survey results on customers decisions to change lighting and/or HVAC equipment during remodeling.

The survey data apply of course to a single period in time. To assess trends over time in the remodeling and renovating of nonresidential buildings, there are two major sources. One source is the Construction Industry Research Board (CIRB), and the other source is F.W. Dodge.

3.1.1 Data from CIRB

One source of data on activity pertaining to remodeling and renovating of nonresidential buildings is the Construction Industry Research Board. 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 CIRB data are aggregated across buildings within a county or city and do not pertain to individual buildings.

For purposes of studying remodeling and renovating, the major data series from CIRB that can be used to examine trends in R&R activity were for value of

[1] This study focused on two utility programs for small/medium nonresidential utility customers: the 1999 Small Business Standard Performance Contract (SBSPC) Program and the statewide 1999 Express Efficiency Program. The final report was issued in December 2000.

permits issued for (1) commercial new construction and (2) nonresidential alterations and additions.

CIRB data on the value of permits issued for nonresidential alterations and additions during 2000 (reproduced in Appendix B) show that the total value of such permits issued was about $7.2 billion. Out of a total of 528 permit-issuing offices, there were 15 offices that accounted for nearly half of this total.

3.1.2 Data from F.W. Dodge

A second source of data pertaining to nonresidential construction activity is F. W. Dodge. Studies of new construction that focus on individual projects have often made use of Dodge data. For example, the statewide Nonresidential New Construction Market Characterization and Program Activity Tracking (MCPAT) Study[2] is tracking trends in both the nonresidential new construction (NRNC) market and in the Savings By Design statewide NRNC program in the years 2000 and 2001. Data from F.W. Dodge as well as from the Construction Industry Research Board are being collected and tabulated for the MCPAT Study.

3.1.3 Comparison of Data Sources

There are concerns about using Dodge data as a basis for studying nonresidential remodeling and renovation. The major concern is that the Dodge data may not provide full coverage of 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.”[3]

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

[2] Quantum Consulting, Inc., *NRNC Market Characterization and Program Activities Tracking Report: PY2000, Final,* April 2001

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

easy to track less-than-major renovations. And maintenance, service, and repair is right off of the map."[4]

Evidence on this point is provided by the comparison shown in Table 3-1, which shows that the proportion of remodeling and renovation in nonresidential construction that is shown in Dodge data is considerably smaller in value than is shown in data compiled and published by the Construction Industry Research Board. These data show the total value of nonresidential construction and of permits issued for nonresidential remodeling and renovation.

Table 3-1. Comparison of Dodge and CIRB Data on Nonresidential Remodeling and Renovation Activity (Values in 000,000)

Year	F. W. Dodge Data		CIRB Data	
	Value of Alterations and Additions	Percent of Total Value Due to Alterations and Additions	Value of Alterations and Additions	Percent of Total Value Due to Alterations and Additions
1995	$ 4,469	37.6%	$4,502	49.9%
1996	$ 3,663	21.3%	$4,966	47.4%
1997	$ 3,558	29.6%	$5,345	41.0%
1998	$ 4,435	14.9%	$5,480	35.5%

As can be seen, there is a significant difference between the two sets of data, with the Dodge data showing the proportion of remodeling and renovation in nonresidential construction to be considerably smaller than shown in the CIRB data. This difference can be even more pronounced in that the value for public facilities owned by federal, state, or local governments as well as some other non-taxable facilities may not be reported in the CIRB permits data, since such facilities may not be required to obtain permits.

3.2 CIRB DATA ON STATEWIDE TRENDS

Statewide trends in remodeling and renovating activity for nonresidential buildings in California can be traced using the data on permitting activity published by the Construction Industry Research Board (CIRB). Figure 3-1 compares the statewide levels of permitting activity for commercial new construction, industrial new construction, and nonresidential alterations and

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

additions from 1967 through 2000. As can be seen, the time trends for the three series differ. These differences are confirmed by the simple correlations calculated for the three series and reported in Table 3-2. 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.

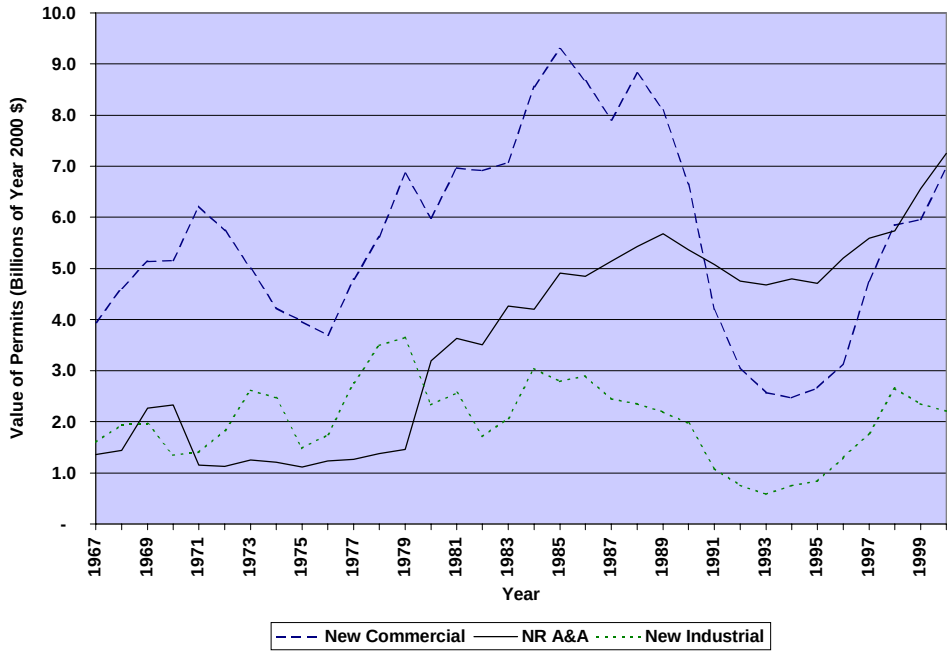

Figure 3-1. Comparison of Statewide Annual Permitting Activity for Commercial New Construction and Nonresidential Alterations and Additions

Table 3-2. 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

The relatively low correlation shown between permitting activity for nonresidential alterations/additions and for new commercial construction is evidence that additions represent a relatively low percentage of the combined total for alterations/additions. As discussed in Chapter 2, 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.

An alternative view of the statewide trend in NR R&R activity can be gotten by considering the share of expenditures on new construction, alterations and additions that are accounted for by alterations and additions. The trend in this share over time 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 been steadily rising over time.

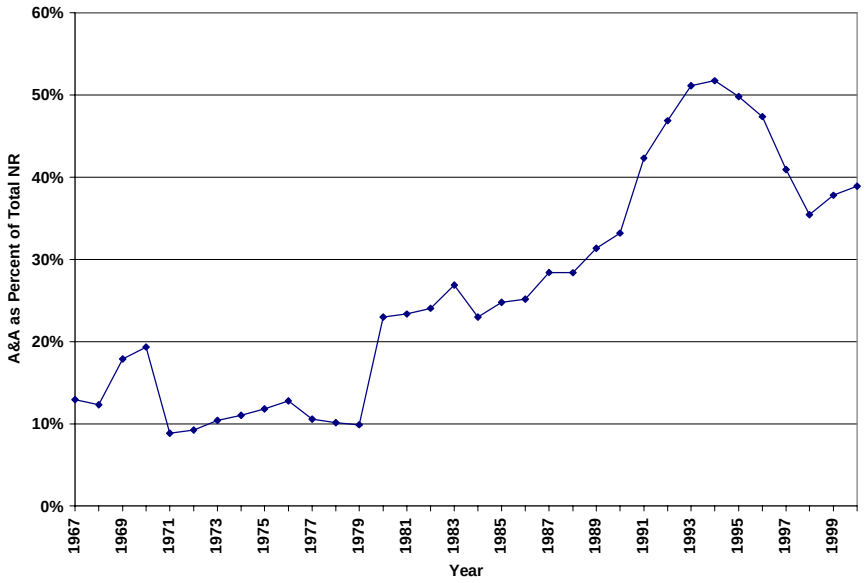

Figure 3-2. Trend in the Share of Total Value of Nonresidential Permits Accounted for by Alterations and Additions

3.3 SUMMARY AND CONCLUSIONS

Extant aggregate data, data being collected in concurrent studies, and qualitative information on remodeling and renovating activity for nonresidential buildings were reviewed in this chapter to delineate trends in the nonresidential remodeling and renovating market in California.

While the correlation between two new construction data series (commercial and industrial) was moderately high, the correlations of a nonresidential alterations and additions data series with the new construction data series were relatively low. 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.

Studies of the nonresidential remodeling and renovating market that are conducted in the future should be aware that each of the two major sources of data on such activity (i.e., F.W. Dodge and CIRB) has limitations.

- Although F.W. Dodge provides readily accessible information on individual projects, the Dodge data may not provide full coverage of remodeling and renovating activity. Moreover, the Dodge data do not provide as long an historical time series as do the CIRB data.
- CIRB data for nonresidential alterations and additions are available for most places in California and for a relatively long period of time. However, the reported CIRB data do not differentiate between alterations and additions, although there is evidence that additions make up only a small percentage of the reported data on alterations and additions. Also, the value for public facilities owned by federal, state, or local governments as well as some other non-taxable facilities may not be reported in the CIRB permits data, since such facilities may not be required to obtain permits.

4. RELATIONSHIP OF NR R&R ACTIVITY TO ELECTRICITY USE

One reason for interest in NR R&R 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 NR R&R activity does affect electricity use. Those results are presented and discussed here.

4.1 A MODEL FOR ANALYZING EFFECTS OF NR R&R ACTIVITY ON ELECTRICITY USE

A simple model relating electricity use to the stock of commercial buildings can be used to analyze the effect of NR R&R 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.

4.2 ANALYSIS OF EFFECTS OF NR R&R 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 4-1 and 4-2. 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 4-1. 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 4-2. 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 4-3 and 4-4. 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 4-3. 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 4-4. 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				

4.3 ANALYSIS OF EFFECTS OF NR R&R 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[1], 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

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

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, since (as will be shown in following chapters) these are the building types that account for most remodeling and renovating activity in California.

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 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 was 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, the panel data set used for the analysis 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.

4.3.1 Results of Office Building Regression Analysis

The results of the regression analysis of electricity use for office buildings are reported in Tables 4-5 and 4-6. NRAAStock 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. OfficeStock is the variable for the stock of new office buildings, calculated as the cumulative sum over time of the value of permits issued for construction of new office buildings.

The regression results reported in Table 4-5 are for a model where dummy variables were entered for each year as well as for each county. The dummy variables for year were entered to determine whether there were any significant differences in electricity use among years that were not being captured by the

stock estimate variables. However, only one of the dummy variables for the year variables had an estimated coefficient that was statistically different than 0.

Because there appeared to be no statistically significant differences among years, a second regression was estimated without the dummy variables for years. The results of this regression are reported in Table 4-6.

- OfficeStock has a coefficient that is statistically significant at the 1 percent level and has the expected positive sign. The magnitude of this coefficient implies that adding $100 (in Year 2000 dollars) to the capital stock of office buildings increases electricity use by about 36 kWh per year.
- NRAAStock has an estimated coefficient that is statistically significant at the 1 percent level and has a negative sign, implying that remodeling or renovating part of the existing office stock does reduce electricity use. An increase of $100 in the stock of remodeled/renovated nonresidential buildings reduces office building electricity use by about 3.8 kWh per year.

Table 4-5. Results of Office Building Electricity Use Regression, With Time Trend

Variables	*Coefficients*	*Standard Error*	*t Statistic*	*P-value*
Dummy Variable,1990	-4,435,685.58	8,891,193.25	-0.5000	0.6181
Dummy variable, 1991	-7,520,466.00	8,797,120.68	-0.8500	0.3930
Dummy variable, 1992	8,005,905.34	8,755,908.08	0.9100	0.3609
Dummy variable, 1993	1,049,936.31	8,722,734.10	0.1200	0.9042
Dummy variable, 1994	-18,305,274.26	8,709,812.88	-2.1000	0.0360
Dummy variable, 1995	-11,115,667.33	8,689,663.64	-1.2800	0.2014
Dummy variable, 1996	-6,005,269.39	8,665,580.28	-0.6900	0.4886
Dummy variable, 1997	11,088,711.71	8,577,413.02	1.2900	0.1966
Dummy variable, 1998	-4,893,913.69	8,542,441.74	-0.5700	0.5669
Dummy variable, 1999	5,211,219.28	8,498,224.60	0.6100	0.5400
OfficeStock	0.3500	0.0240	14.7900	<.0001
NRAAStock	-0.0400	0.0050	-7.5700	<.0001
Number of observations = 638 R-squared = 0.998				

Table 4-6. Results of Office Building Electricity Use Regression, No Time Trend

Variables	*Coefficients*	*Standard Error*	*t Statistic*	*P-value*
OfficeStock	0.3612	0.0232	15.58	<.0001
NRAAStock	-0.0382	0.0049	-7.74	<.0001
Number of observations = 638 R-squared = 0.998				

4.3.2 Results of Retail Store Regression Analysis

The results of the regression analysis of electricity use for retail stores are reported in Table 4-7. NRAAStock 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. RetailStock is the variable for the stock of new retail

store buildings, calculated as the cumulative sum over time of the value of permits issued for construction of new retail stores. The regression results reported in Table 4-7 are for a model where dummy variables were entered for each year as well as for each county.

- As with the office building regression analysis, the dummy variables for the different years were entered to determine whether there were any significant differences in electricity use among years that were not being captured by the stock estimate variables. Six out of the ten dummy variables for the year variables had estimated coefficients that were statistically different than 0, indicating that there were influences in those years beyond the stock variables that were causing electricity use to be different (generally higher) than in 2000.
- RetailStock has a coefficient that is statistically significant at the 1 percent level and has the expected positive sign. The magnitude of this coefficient implies that adding $100 (in Year 2000 dollars) to the capital stock of retail stores increases electricity use by about 14 kWh per year.
- NRAAStock has an estimated coefficient that is statistically significant at the 1 percent level and has a positive sign, implying that remodeling or renovating of the existing stock of buildings increases electricity use of 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.

Table 4-7. Results of Retail Store Electricity Use Regression, With Time Trend

Variables	*Coefficients*	*Standard Error*	*t Statistic*	*P-value*
Dummy Variable,1990	14,009,799.96	3,604,107.06	3.89	0.0001
Dummy variable, 1991	8,333,465.09	3,559,588.35	2.34	0.0196
Dummy variable, 1992	8,359,351.78	3,520,460.68	2.37	0.0179
Dummy variable, 1993	7,377,961.89	3,493,366.76	2.11	0.0351
Dummy variable, 1994	-21,312.29	3,468,108.91	-0.01	0.9951
Dummy variable, 1995	3,310,811.83	3,445,598.82	0.96	0.3370
Dummy variable, 1996	2,417,210.72	3,424,272.56	0.71	0.4805
Dummy variable, 1997	7,468,088.66	3,404,460.66	2.19	0.0287
Dummy variable, 1998	-1,908,053.81	3,404,175.83	-0.56	0.5754
Dummy variable, 1999	7,066,055.12	3,393,411.87	2.08	0.0378
RetailStock	0.1400	0.0080	18.5	<.0001
NRAAStock	0.0100	0.0020	5.49	<.0001
Number of observations = 638 R-squared = 0.998				

4.4 SUMMARY AND CONCLUSIONS

This chapter presented the results of analyzing the effects of remodeling and renovating activity on electricity use. Two sets of data were used for the analysis.

- One set of data represented statewide electricity use for the commercial sector, aggregated across building types. These data covered a period of years from 1967 through 1999.
- A second set of data represented electricity use defined by commercial building type and by county. These data covered a period of years from 1983 through 2000.

The results of the two sets of analyses were generally consistent in showing that remodeling and renovating activity has statistically significant effects in reducing electricity use. The exception was the analysis for retail buildings, where remodeling and renovating activity was shown to increase electricity use. The reasons for this exception are open to further study. For example, it might be conjectured that display lighting (which is not governed closely by Title 24 requirements) is upgraded when retail facilities are remodeled or renovated. However, further study is required to confirm or deny this or other hypotheses about the effects of remodeling and renovating on energy use in retail facilities.

5. REMODELING AND RENOVATING ACTIVITY IN CALIFORNIA BY GEOGRAPHIC AREA

Chapter 3 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 chapter 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 rentals and other market conditions that can differ among regions. Climate conditions and energy prices may also differ among regions.

Although our generic 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. As discussed in Chapter 2, the CIRB data provide good coverage of activity to change nonresidential buildings. Although the CIRB data include additions with alterations, the evidence is that additions are a relatively small percentage of the total of alterations and additions. Accordingly, the CIRB data are used in the analysis reported here as a proxy indicator for remodeling and renovating activity, but with the caveat that the inclusion of additions with alterations will somewhat overstate the magnitude of the activity involved in making changes to nonresidential buildings.

5.1 REGIONAL MARKETS FOR NR A&A

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 NR R&R activity. The time series data on permits issued by cities and counties have been aggregated to nine regions and used to examine whether there are correlations in permit issuing activity among regions and how R&R activity correlates with new construction activity. The counties in each region are shown in Figure 5-1. The regions correspond to the regions for which CIRB calculates cost indexes.

The relative importance of the regions in terms of both commercial new construction and nonresidential alterations and additions is shown in Table 5-2 and Figure 5-1. In 2000, two regions (i.e., San Francisco Bay and Los Angeles) accounted for about 70.9 percent of the value of permits issued for commercial new construction and for about 78.6 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 69.8 percent of the value of permits

issued for commercial new construction and for about 75.3 percent of the value of permits issued for nonresidential alterations and additions.

Table 5-1. Analysis Regions and Counties Included

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		

Table 5-2. 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	

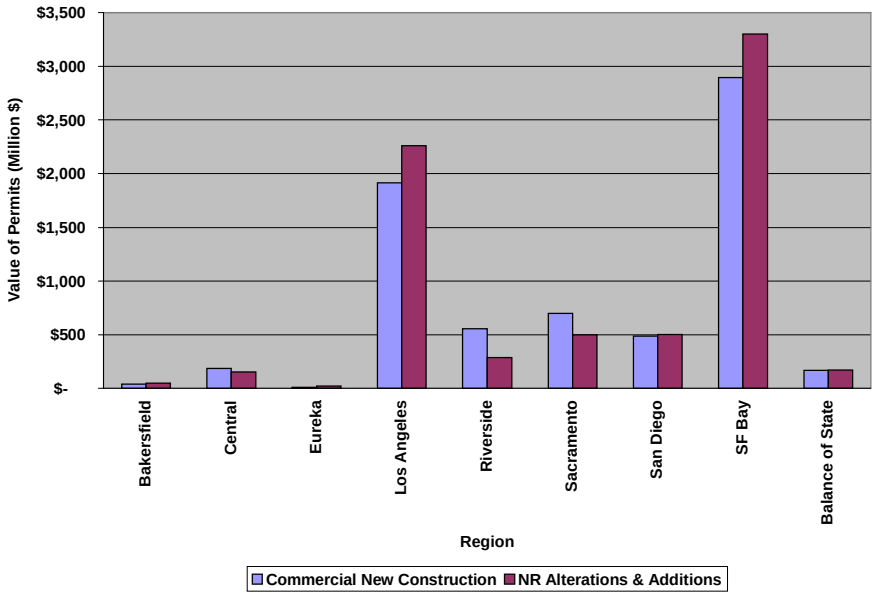

Figure 5-1. Comparison across Regions of Value of Permits for Commercial New Construction and Nonresidential Alterations and Additions Issued during 2000

5.2 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 5-2 and 5-3 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.

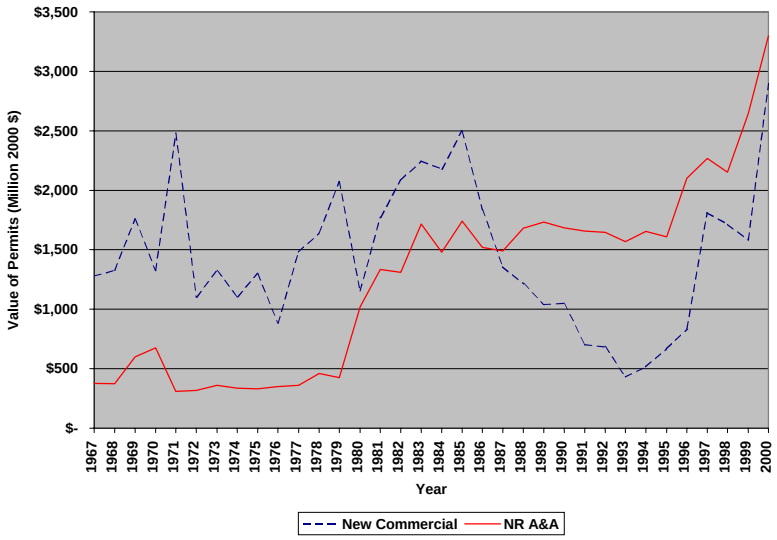

Figure 5-2. Comparison of Trends over Time for Permitting Activity for Commercial New Construction and Nonresidential Alterations and Additions for San Francisco Bay Region

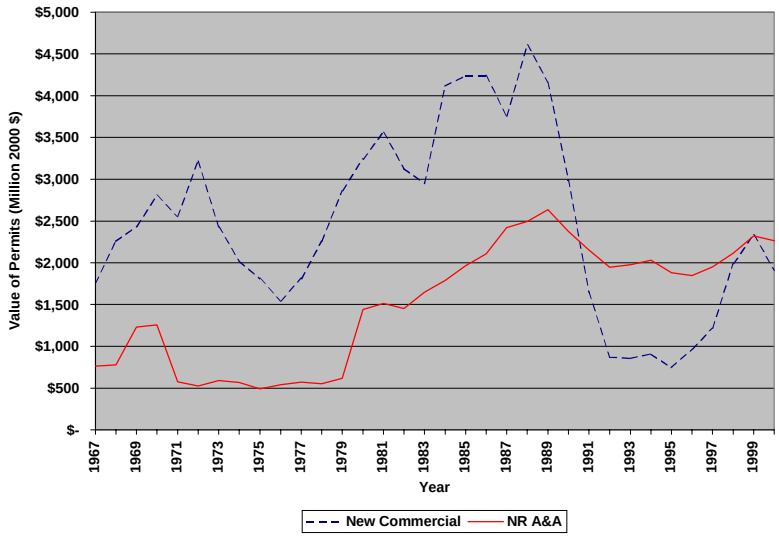

Figure 5-3. Comparison of Trends over Time for Permitting Activity for Commercial New Construction and Nonresidential Alterations and Additions for Los Angeles Region

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

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

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

5.3 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 among regions, correlations were calculated among the alterations and additions series for the various regions. The correlations, which are reported in Table 5-4, are relatively high for the most part. This is indicative that the factors that affect nonresidential alteration and additions activity are similar across the various regions of the state.

Table 5-4. 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

5.4 CORRELATION OF COMMERCIAL NEW CONSTRUCTION ACTITIVTY 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 5-5. 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 5-5. 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

5.5 REGRESSION ANALYSIS OF FACTORS AFFECTING NEW CONSTRUCTION AND R&R ACTIVITY

The graphical and correlation analyses suggested that nonresidential remodeling and renovating activity has followed a pattern over time that is different than new commercial construction. Regression analyses were used to test further for the existence of this difference.

In the regression analyses, the values of permits issued for nonresidential alterations and additions and for new commercial construction in the different regions were regressed against rate of return measures for commercial properties. The underlying hypothesis is that higher rates of return for commercial properties will induce greater investment both in constructing new properties and in remodeling or renovating existing properties.

The rate of return measure used in the regression analysis was the NCREIF Property Index (NPI) for the western United States.[1] NPI is the most commonly used index of US based investment performance for income property traditionally held in the private equity format. The NPI is based on the appraised values of properties held for tax-exempt institutions by members of the National Council of Real Estate Investment Fiduciaries (NCREIF). NPI is populated with data derived from consistently applied standards and is the most widely used measure of investment performance in real estate. Currently, the index includes approximately 2,500 domestic institutionally owned properties with a market value exceeding $75 billion. Figure 5-4 shows the movement over time of the quarterly NPI for the western United States. (The NPI is reported on a quarterly basis.)

[1] States included in the western region are California, Oregon, Washington, Arizona, Nevada, Idaho, Montana, Utah, Colorado, Wyoming, and New Mexico.

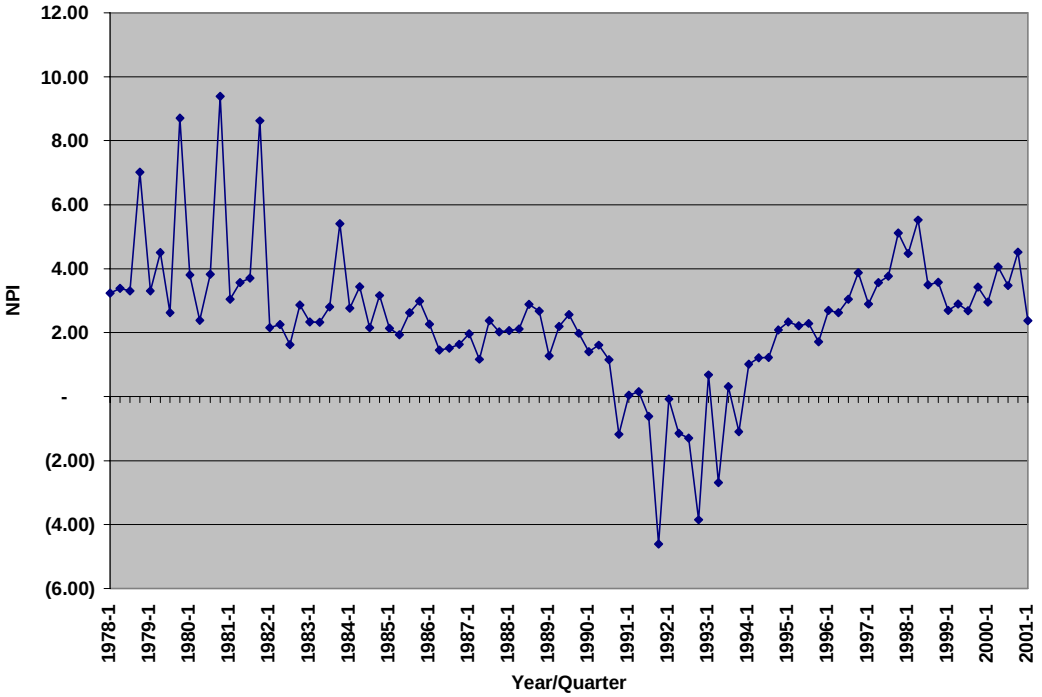

Figure 5-4. NCREIF NPI for Western Region

The equations used for the regression analysis were as follows:

$$\text{ValComPermits}_t = \alpha_o + \alpha_1 \text{NPI\_Qtr1}_{t-1} + \alpha_2 \text{NPI\_Qtr2}_{t-1} + \alpha_3 \text{NPI\_Qtr3}_{t-1} + \alpha_4 \text{NPI\_Qtr4}_{t-1}$$

where ValComPermts_t is the value of permits issued for new commercial construction in year t; ValNRA&A permits is the value of permits issued for nonresidential alterations and additions in year t; and NPI_Qtr is the NPI index for various quarters of the year. Because a lag would be expected between when property returns were determined and when preparation for new construction or alterations and additions began, current values of permit activity are hypothesized to be determined by NPI values in the previous year. The results of the regression analyses for the various regions are reported in Table 5-6 for nonresidential alterations and additions and in Table 5-7 for new commercial construction. Each regression has 22 observations, covering the time period from 1979 through 2000.

The results for nonresidential alterations and additions reported in Table 5-6 show the following:

- The NPI variables for quarters 1 and 2 of the previous year do not have statistically significant effects on the value of permits issued for nonresidential alterations and additions in the current year.
- Both of the NPI variables for quarters 3 and 4 of the previous year are statistically significant in five of the regressions. In the other four regressions, the NPI variable for quarter 4 is statistically significant but the variable for quarter 3 is not.

The results for new commercial construction show the following:

- The NPI variables for quarters 1 and 2 of the previous year do not have statistically significant effects on the value of permits issued for new commercial construction in the current year.
- Both of the NPI variables for quarters 3 and 4 of the previous year are statistically significant in three of the regressions (i.e.. for the Central region, the Riverside region, and the Sacramento region). In the other six regressions, the NPI variables for quarters 3 and 4 are not statistically significant.

The differences between the two sets of regressions become more pronounced when the two regions with the highest levels of activity are considered.

- For the San Francisco Bay region, none of the NPI variables is statistically significant in the regression for new commercial construction. The NPI variable for the fourth quarter is statistically significant in the regression for nonresidential alterations and additions.
- For the Los Angeles region, none of the NPI variables is statistically significant in the regression for new commercial construction. The NPI variables for the third and fourth quarter are statistically significant in the regression for nonresidential alterations and additions.

Taken together, the graphic, correlation and regression analyses point to differences between the factors determining nonresidential alterations and additions and those determining new commercial construction. Rate of return data appear to have statistical significance in explaining movements in permitting activity for nonresidential alterations and additions but not in explaining movements in permitting activity for commercial new construction.

5.6 SUMMARY

The analyses reported on in this chapter use data for different regions of California to address two research questions:

- What has been the relationship of remodeling and renovating activity for nonresidential buildings to the new construction of nonresidential buildings?
- Are the factors that determine remodeling and renovating activity the same as those that determine new construction activity?

The results presented in this chapter have shown the following.

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.

Correlations between the data series for nonresidential alterations and additions and for commercial new construction were calculated for different regions. The relatively low correlations between the data series for the two largest regions suggest 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 geographical differences across regions in the factors affecting new construction of commercial buildings.

Although extensive modeling to identify the factors affecting the two types of construction activity was beyond the scope for this study, some preliminary analysis was undertaken. Regression analyses were used in which the values of permits issued for nonresidential alterations and additions and for new commercial construction in the different regions were regressed against rate of return measures for commercial properties. The hypothesis being tested was whether higher rates of return for commercial properties induce greater investment both in constructing new properties and in remodeling or renovating existing properties. The results of the regression analyses were different for the two types of construction activity. Rate of return data appear to have statistical significance in explaining movements in permitting activity for nonresidential alterations and additions but not in explaining movements in permitting activity for commercial new construction.

Table 5-6. Results of Regression Analysis of Nonresidential Alterations and Additions by Region

CIRB Region	Parameter	Estimate	Standard Error	t Value	Pr > |t|	R-squared
Bakersfield	Intercept	33.72	6.04	5.58	<.0001	0.407
	NPI_Qtr1_Lag1Year	-1.11	4.86	-0.23	0.822	
	NPI_Qtr2_Lag1Year	-0.42	2.33	-0.18	0.858	
	NPI_Qtr3_Lag1Year	8.91	3.76	2.37	0.030	
	NPI_Qtr4_Lag1Year	-3.72	1.22	-3.04	0.007	
Central	Intercept	87.07	16.35	5.33	<.0001	0.344
	NPI_Qtr1_Lag1Year	-3.12	13.14	-0.24	0.815	
	NPI_Qtr2_Lag1Year	7.36	6.31	1.17	0.259	
	NPI_Qtr3_Lag1Year	11.74	10.16	1.16	0.264	
	NPI_Qtr4_Lag1Year	-8.35	3.31	-2.52	0.022	
Eureka	Intercept	16.50	2.42	6.81	<.0001	0.339
	NPI_Qtr1_Lag1Year	-1.48	1.95	-0.76	0.459	
	NPI_Qtr2_Lag1Year	1.42	0.93	1.52	0.146	
	NPI_Qtr3_Lag1Year	1.50	1.51	1.00	0.332	
	NPI_Qtr4_Lag1Year	-1.04	0.49	-2.11	0.050	
Los Angeles	Intercept	1,710.03	218.22	7.84	<.0001	0.510
	NPI_Qtr1_Lag1Year	5.77	175.31	0.03	0.974	
	NPI_Qtr2_Lag1Year	-26.78	84.15	-0.32	0.754	
	NPI_Qtr3_Lag1Year	361.03	135.64	2.66	0.016	
	NPI_Qtr4_Lag1Year	-169.00	44.23	-3.82	0.001	
Riverside	Intercept	168.59	30.40	5.55	<.0001	0.560
	NPI_Qtr1_Lag1Year	-12.16	24.42	-0.50	0.625	
	NPI_Qtr2_Lag1Year	6.23	11.72	0.53	0.602	
	NPI_Qtr3_Lag1Year	62.32	18.90	3.30	0.004	
	NPI_Qtr4_Lag1Year	-25.98	6.16	-4.22	0.001	
Sacramento	Intercept	252.35	39.98	6.31	<.0001	0.593
	NPI_Qtr1_Lag1Year	16.94	32.12	0.53	0.605	
	NPI_Qtr2_Lag1Year	-1.48	15.42	-0.10	0.925	
	NPI_Qtr3_Lag1Year	71.34	24.85	2.87	0.011	
	NPI_Qtr4_Lag1Year	-38.81	8.10	-4.79	0.000	
San Diego	Intercept	196.74	49.92	3.94	0.001	0.568
	NPI_Qtr1_Lag1Year	47.39	40.10	1.18	0.254	
	NPI_Qtr2_Lag1Year	9.31	19.25	0.48	0.635	
	NPI_Qtr3_Lag1Year	65.72	31.03	2.12	0.049	
	NPI_Qtr4_Lag1Year	-46.61	10.12	-4.61	0.000	
San Francisco Bay	Intercept	1,053.71	304.77	3.46	0.003	0.411
	NPI_Qtr1_Lag1Year	275.95	244.84	1.13	0.275	
	NPI_Qtr2_Lag1Year	12.73	117.52	0.11	0.915	
	NPI_Qtr3_Lag1Year	295.53	189.44	1.56	0.137	
	NPI_Qtr4_Lag1Year	-208.22	61.77	-3.37	0.004	
Balance of State	Intercept	119.74	14.69	8.15	<.0001	0.385
	NPI_Qtr1_Lag1Year	8.34	11.80	0.71	0.489	
	NPI_Qtr2_Lag1Year	-0.79	5.66	-0.14	0.890	
	NPI_Qtr3_Lag1Year	9.92	9.13	1.09	0.292	
	NPI_Qtr4_Lag1Year	-8.77	2.98	-2.95	0.009	

Table 5-7. Results of Regression Analysis of Commercial New Construction by Region

CIRB Region	Parameter	Estimate	Standard Error	t Value	Pr > |t|	R-squared
Bakersfield	Intercept	101.47	25.84	3.93	0.001	0.043
	NPI_Qtr1_Lag1Year	-17.10	20.76	-0.82	0.421	
	NPI_Qtr2_Lag1Year	5.87	9.97	0.59	0.564	
	NPI_Qtr3_Lag1Year	0.35	16.06	0.02	0.983	
	NPI_Qtr4_Lag1Year	2.62	5.24	0.50	0.623	
Central	Intercept	126.10	15.70	8.03	<.0001	0.400
	NPI_Qtr1_Lag1Year	-15.23	12.62	-1.21	0.244	
	NPI_Qtr2_Lag1Year	10.58	6.06	1.75	0.099	
	NPI_Qtr3_Lag1Year	20.11	9.76	2.06	0.055	
	NPI_Qtr4_Lag1Year	-7.49	3.18	-2.35	0.031	
Eureka	Intercept	32.34	7.09	4.56	0.000	0.108
	NPI_Qtr1_Lag1Year	-1.03	5.69	-0.18	0.859	
	NPI_Qtr2_Lag1Year	0.67	2.73	0.24	0.810	
	NPI_Qtr3_Lag1Year	-3.65	4.41	-0.83	0.419	
	NPI_Qtr4_Lag1Year	0.55	1.44	0.38	0.706	
Los Angeles	Intercept	1,766.62	788.75	2.24	0.039	0.273
	NPI_Qtr1_Lag1Year	-57.09	633.64	-0.09	0.929	
	NPI_Qtr2_Lag1Year	-36.17	304.15	-0.12	0.907	
	NPI_Qtr3_Lag1Year	348.41	490.28	0.71	0.487	
	NPI_Qtr4_Lag1Year	93.70	159.87	0.59	0.566	
Riverside	Intercept	422.85	96.18	4.40	0.000	0.340
	NPI_Qtr1_Lag1Year	-62.43	77.27	-0.81	0.430	
	NPI_Qtr2_Lag1Year	19.52	37.09	0.53	0.606	
	NPI_Qtr3_Lag1Year	148.59	59.79	2.49	0.024	
	NPI_Qtr4_Lag1Year	-45.73	19.50	-2.35	0.031	
Sacramento	Intercept	353.70	79.00	4.48	0.000	0.512
	NPI_Qtr1_Lag1Year	-56.87	63.46	-0.90	0.383	
	NPI_Qtr2_Lag1Year	16.45	30.46	0.54	0.596	
	NPI_Qtr3_Lag1Year	179.28	49.10	3.65	0.002	
	NPI_Qtr4_Lag1Year	-46.71	16.01	-2.92	0.010	
San Diego	Intercept	323.31	158.00	2.05	0.057	0.206
	NPI_Qtr1_Lag1Year	-9.63	126.93	-0.08	0.940	
	NPI_Qtr2_Lag1Year	7.26	60.93	0.12	0.907	
	NPI_Qtr3_Lag1Year	107.34	98.21	1.09	0.290	
	NPI_Qtr4_Lag1Year	-11.09	32.02	-0.35	0.733	
San Francisco Bay	Intercept	746.17	367.40	2.03	0.058	0.438
	NPI_Qtr1_Lag1Year	174.65	295.15	0.59	0.562	
	NPI_Qtr2_Lag1Year	58.35	141.68	0.41	0.686	
	NPI_Qtr3_Lag1Year	56.14	228.37	0.25	0.809	
	NPI_Qtr4_Lag1Year	30.79	74.47	0.41	0.684	
Balance of State	Intercept	154.88	32.09	4.83	0.000	0.182
	NPI_Qtr1_Lag1Year	0.09	25.78	0.00	0.997	
	NPI_Qtr2_Lag1Year	8.38	12.37	0.68	0.507	
	NPI_Qtr3_Lag1Year	15.43	19.95	0.77	0.450	
	NPI_Qtr4_Lag1Year	-4.75	6.50	-0.73	0.475	

6. CHARACTERISTICS OF NONRESIDENTIAL BUILDINGS UNDERGOING REMODELING OR RENOVATION: CASE STUDIES

The analyses presented in Chapters 4 and 5 used data from the Construction Industry Research Board to examine broad trends in nonresidential remodeling and renovating activity in California. However, the CIRB data used for that analysis are not reported broken down by building type. Data were presented in Table 2-1 that showed differences among building types in the percentages of capital expenditures for new construction, remodeling and renovating that were accounted for by remodeling and renovating expenditures. The percentages reported in Table 2-1 were nationwide estimates. The purpose of this chapter is to examine the characteristics of buildings undergoing remodeling or renovating using data more specific to California.

6.1 ANALYSIS OF A&A PERMITS FOR SELECTED CITIES

As part of the data collection effort for this study, 50 permit-issuing offices were contacted to obtains listings of all permits issued by the offices during 2000. The manner in which an office's listing of permits could be obtained varied, depending on the particular circumstances by which an office made the data available. Some offices post listings of permits issued on their web sites, although most do not. Accordingly, telephone and in-person contacts were made with the 50 offices to obtain the lists of nonresidential permits that were issued during 2000.

Building permits are public records and are supposed to be open to inspection. In fact, however, accessibility of the records varies across permit-issuing offices. Because the form in which the listings of permits were available differed among offices, each office was dealt with on a one-to-one basis to determine the most convenient manner for an office to provide the permits listing. A general issue in identifying permit documentation for a building pertained to the filing systems used by the departments. Either an address or an assessor's parcel number is generally needed to identify a building and access its permit documentation. Some building departments prepare a listing of all permits issued in a given year; this listing generally shows the permit number and the address of the premise for which the permit is issued. The availability of such listings facilitates identifying the permit number for a given site. However, not all building departments prepare such listings. In cases where such listings were not available, more coordination with the building department personnel was required to access the permit information.

Some permit-issuing offices (e.g., City of Los Angeles, City of San Jose,) had computerized listings of the permits issued. (Such computerized listings were not available for all offices.) However, because several of the largest cities could make permit data available in computerized form, analyses could be performed using data for individual buildings.

In particular, data for five cities were used for more detailed analysis of the types of buildings that underwent alterations and additions during 2000. These cities and the CIRB region in which they are located are shown in Table 6-1.

Table 6-1. Cities with Detailed Permit Data and CIRB Region

City	***CIRB Region***
City of Los Angeles	Los Angeles
City of Irvine	Los Angeles
City of San Jose	SF Bay
City of Sunnyvale	SF Bay
City of Sacramento	Sacramento

The analysis of these five cities are used as representative case studies of the type of activity occurring at the local level.

- These five cities were among the fifteen cities accounting for almost half of the value of permits issued for nonresidential alterations and additions in 2000. The five cities themselves accounted for about 20 percent of the total value of permits issued for nonresidential alterations and additions.
- Based on CIRB data on the value of permits issued for nonresidential alterations and additions during 2000, the City of Los Angeles and the City of Irvine are the two largest issuers of such permits in CIRB's Los Angeles region. Together, the two cities accounted for 30 percent of the total value of permits issued for nonresidential alterations and additions in the Los Angeles region during 2000.
- For CIRB's San Francisco Bay region, San Jose is the second largest issuer of permits for nonresidential alterations and additions (following San Francisco), while Sunnyvale is the fifth (following San Francisco, San Jose, Santa Clara, and Milpitas). Together, San Jose and Sunnyvale accounted for 21 percent of the total value of permits issued for nonresidential alterations and additions in the SF Bay region during 2000.
- Sacramento is the largest issuer of permits for nonresidential alterations and additions in CIRB's Sacramento region, accounting for 18.5 percent of the total value of such permits issued in the region during 2000.

6.2 NONRESIDENTIAL A&A IN THE CITY OF LOS ANGELES

The data on permits for additions or for alterations/repairs of nonresidential buildings issued by the City of Los Angeles for the Year 2000 are summarized in Table 6-2.

Table 6-2. Number and Value of Permits Issued for Additions and Alterations/Repairs of Different Types of Nonresidential Buildings in City of Los Angeles during 2000 (Value in Dollars)

Type of Building	Additions			Alterations/Repairs		
	Number of Permits	Value of Permits	Average Value	Number of Permits	Value of Permits	Average Value
Office Buildings	68	11,499,259	169,107	2,778	270,719,868	97,451
Retail Stores	45	9,745,905	216,576	1,385	58,946,821	42,561
Warehouses	21	5,047,480	240,356	293	24,829,090	84,741
Manufacturing Bldgs	24	6,490,901	270,454	400	18,569,844	46,425
Miscellaneous Bldgs	19	2,312,000	121,684	400	16,854,336	42,136
Restaurants	24	2,043,000	85,125	486	14,639,728	30,123
Unknown	15	4,004,122	266,941	228	14,512,821	63,653
Garages, Public	35	4,489,102	128,260	250	12,416,628	49,667
Hotels	7	50,136,000	7,162,286	92	11,748,401	127,700
Amusement Buildings	6	974,192	162,365	79	11,659,580	147,590
Airport Buildings	4	15,770,000	3,942,500	43	7,608,224	176,935
Churches	14	3,502,536	250,181	132	6,894,880	52,234
Theater Buildings	1	300	300	47	6,457,244	137,388
School Buildings	14	3,477,301	248,379	107	4,317,733	40,353
Apartment Buildings	5	1,110,301	222,060	84	3,879,194	46,181
Hospitals	4	302,000	75,500	27	2,336,104	86,522
Public Admin Bldgs	2	739,920	369,960	48	1,356,204	28,254
Gasoline Stations	3	171,000	57,000	71	679,356	9,568
Garages, Private	3	172,500	57,500	26	542,502	20,865
Dwellings, Single	4	129,000	32,250	33	384,603	11,655
Dwellings, Duplex	1	34,000	34,000	12	278,180	23,182
Public Utilities Bldgs	1	7,040	7,040	3	180,301	60,100
Totals	320	122,157,859	381,743	7,024	489,811,642	69,734

The data reported in Table 6-1 show the following.

- The total value of permits for additions totaled just over $122 million, while the total value for permits for alterations/repairs totaled just under $490 million.[1] However, over half of the total value of permits for additions was accounted for by only 11 buildings (four airport buildings and seven hotels).

[1] The sum of these two (i.e., 122 + 490 = 612) is greater than the value reported for L.A. by the CIRB (see Appendix A). The reason for this difference is not apparent.

- As with the nationwide and statewide data cited above, offices and retail stores accounted for most of the alteration and/or repair activity. Offices accounted for 55 percent of the total value of permits issued for alterations or repairs, while retail stores accounted for 12 percent.
- When ranked by average value of a permit for alterations/repairs, airport buildings had the highest average, followed by amusement buildings, theater buildings, and hotels.

The distribution for value of permits issued for alterations/repairs of offices is skewed, as shown in Figure 6-1.

- About 10 percent of the permits accounted for about 64 percent of the total value of permits issued for alterations/repairs to office buildings. About 20 percent of the permits accounted for about 79 percent of the total value.
- There were 1,012 permits issued with a value of $50,000 or higher. These permits accounted for about 36 percent of the permits issued but for about 90 percent of the total value.

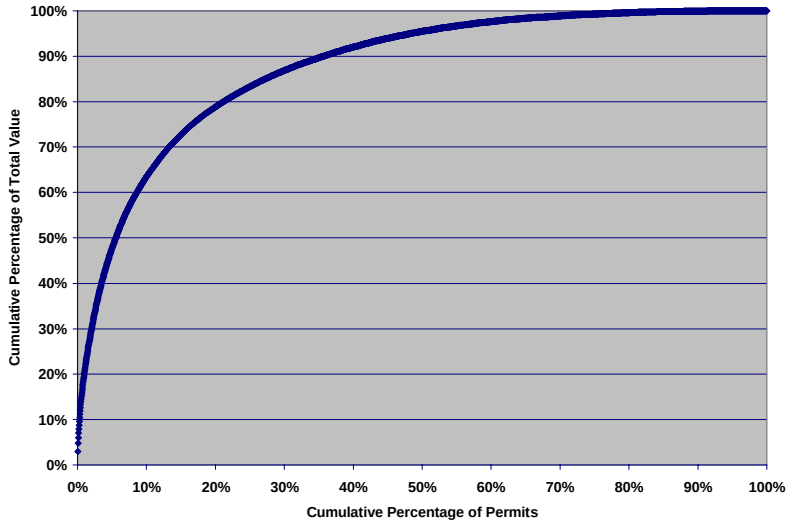

Figure 6-1. Distribution of Permits for Office Alterations/Repairs Issued by City of Los Angeles during 2000

The distribution for value of permits issued for alterations/repairs of retail stores is shown in Figure 6-2. As for offices, the distribution for retail stores is skewed.

- About 10 percent of the permits for retail accounted for about 63 percent of the total value of permits issued for alterations/repairs to office buildings. About 20 percent of the permits accounted for about 78 percent of the total value.

- There were 277 permits issued with a value of $50,000 or higher. These permits accounted for about 20 percent of the permits issued but for about 78 percent of the total value.

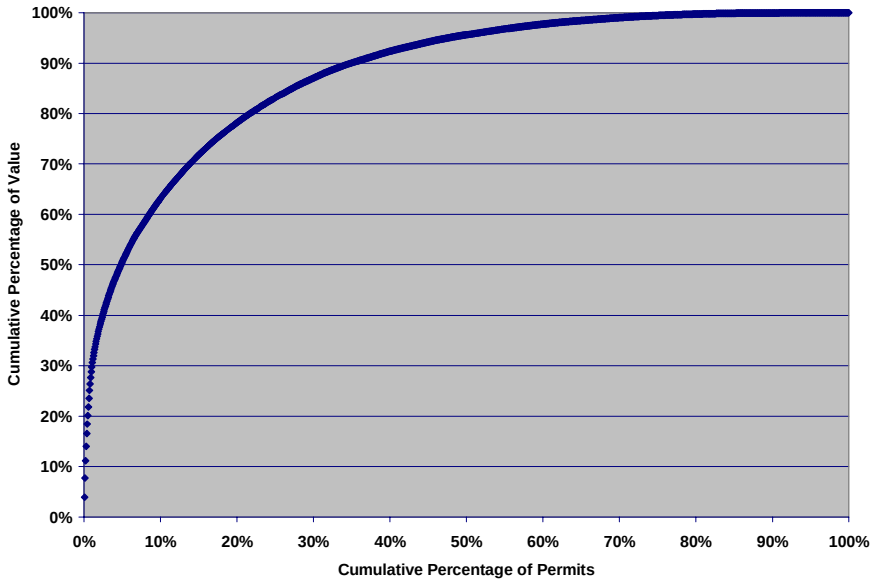

Figure 6-2. Distribution of Permits for Retail Alterations/Repairs Issued by City of Los Angeles during 2000

6.3 NONRESIDENTIAL A&A IN THE CITY OF SAN JOSE

According to CIRB tabulations, the value of permits for nonresidential alterations and additions issued by the City of San Jose during 2000 was about $510 million. Data for the individual permits that were issued by the City of San Jose were obtained and analyzed to identify major characteristics for the type of A&A projects being undertaken during 2000.

The value of nonresidential A&A permits issued by the City of San Jose is broken down in Table 6-3 according to type of building and type of A&A activity.

Table 6-3. Value of Permits Issued by City of San Jose during 2000 for Nonresidential A&A, Classified by Type of Building and Type of A&A Activity (Value in Dollars)

Type of A&A Activity	Type of Building					Total
	Commercial	Office	Retail	Restaurant	Industrial	
Building A&A	61,795,155	2,129,037	251,740		36,043,480	100,219,412
Electrical A&A	14,268,888	179,364	232,050	40,000	8,053,760	22,774,062
Interior A&A	68,185,170	6,502,762	4,131,025	1,386,978	184,394,748	264,600,684
Interior Electric	17,593,709	201,000	683,000	40,251	60,685,012	79,202,972
Seismic Upgrade	6,789,891				450,000	7,239,891
Tenant A&A	297,952					297,952
Tenant Improvements	18,073,293	332,166	1,535,840	46,691	15,682,723	35,670,714
Other	911,643				20,000	931,643
Total	187,915,702	9,344,329	6,833,655	1,513,920	305,329,723	510,937,330

When the type of buildings for which A&A permits were issued are considered, there are several noticeable differences between San Jose and Los Angeles.

- Nearly 60 percent of the value of permits issued for nonresidential A&A by the City of San Jose was for buildings that the City of San Jose classified as industrial. Further information as to the types of buildings within the industrial classification is not available. By contrast, only a relatively small percentage of the nonresidential A&A occurring in Los Angeles was for manufacturing buildings.
- While the value of permits issued by the City of Los Angeles for alterations or additions to office buildings and retail stores were relatively high, the data for San Jose show smaller percentages of A&A activity occurring for these types of buildings. However, further information as to the types of buildings that were classified as receiving commercial A&A is not available. It is possible that offices and retail stores are also included in the commercial category.

The data from the City of San Jose do allow a more detailed look at the types of activities that are associated with altering or adding to nonresidential buildings. Table 6-3 indicates that just over half (51.8 percent) of the value of permits issued for nonresidential A&A was associated with interior alteration and additions.

Similar data on the types of activities that are undertaken for new construction suggest that some of these activities could be considered part of the remodeling activity. Table 6-4 shows the value of permits issued by the City of San Jose broken down according to type of building and type of construction activity. The value of permits for new construction is somewhat larger than the value for A&A (i.e., $528 million versus $510 million). However, about a fifth (18.7 percent) of the value of permits for new construction activity is associated with interior finishing to constructed building shells.

Table 6-4. Value of Permits Issued by City of San Jose during 2000 for Nonresidential New Construction, Classified by Type of Building and Type of Construction Activity (Value in Dollars)

Type of Building	Type of New Construction Activity				Total
	Foundation Only	Building Finish	Interior Finish	New Construction	
Office	19,469,612	62,293,035	55,653,207	76,630,867	214,046,721
Industrial	8,855,223	60,685,880	32,579,769	67,739,101	169,859,973
Store	1,393,799	4,850,577	8,802,670	47,687,131	62,734,177
Parking Garage	604,494	13,913,573		26,908,246	41,426,313
Hotel	1,082,034	10,896,466		15,044,100	27,022,600
No Building	450,000	4,050,000			4,500,000
Power & Utilities			2,000,000		2,000,000
Religious				2,000,000	2,000,000
Service Garage				1,850,400	1,850,400
School	257,077	1,227,845			1,484,922
Amusement		437,812		483,426	921,238
Miscellaneous				750,000	750,000
Total	32,112,240	158,355,187	99,035,646	239,093,271	528,596,343

6.4 NONRESIDENTIAL A&A IN THE CITY OF SUNNYVALE

Data on the value of permits issued by the City of Sunnyvale were tabulated to show the distribution of value by type of building and by type of A&A activity. This tabulation is shown in Table 6-5.

- Out of a total valuation of about $205.5 million for permits for alterations or additions to nonresidential buildings, 51.8 percent was for alterations or additions on office buildings. Industrial buildings accounted for 41.4 percent.
- Repairs, alteration and remodeling activity accounted for 98.2 percent of the total valuation.

Table 6-5. Value of Permits Issued by City of Sunnyvale during 2000 Classified by Type of Building and Type of Construction Activity (Value in Dollars)

Type of Building	Type of A&A Activity		Totals
	Addition	Repair, Alteration, Remodel	
Office	1,063,287	105,454,187	106,517,474
Industrial	1,000,000	84,060,829	85,060,829
Retail Stores		3,976,013	3,976,013
Parking Garage		3,245,111	3,245,111
Public Works/ Utilities	1,500,000	1,254,121	2,754,121
Other Non-Res	48,000	1,815,280	1,863,280
Restaurant		702,446	702,446
Hotel/Motel		481,079	481,079
Swimming Pools	55,000	196,082	251,082
Signs		246,577	246,577
Service Station/Repair		194,122	194,122
Other Non-Res		123,147	123,147
Religious Bldg	1,500	112,045	113,545
Schools/Educational		52,458	52,458
Totals	3,667,787	201,913,497	205,581,284

6.5 NONRESIDENTIAL A&A IN THE CITY OF IRVINE

The City of Irvine supplied information on 848 commercial permits issued for alterations, additions, or tenant improvements to nonresidential buildings in that city during 2000. Although the city did not supply information on the value of each permit, it did provide information on the type of facility and on the square footage affected by the permitted activity. These data are summarized in Table 6-6. Out of nearly 6.6 million square feet of space affected, about 73 percent was in office buildings.

Table 6-6. Number of Commercial Permits for Tenant Improvements and Square Footage Affected for City of Irvine

Type of Building	Number of Permits	Square Footage Affected by Permit	Affected Square Footage as Percent of Total
Office	507	4,794,491	72.8%
Retail	58	353,011	5.4%
Industrial/Manufacturing	13	412,510	6.3%
Other	270	1,028,686	15.6%
Totals	848	6,588,698	

Figure 6-3 shows that the distribution of permit square footage for offices is skewed. About 20 percent of the office permits (101 in number) account for about 73 percent of the square footage undergoing tenant improvements.

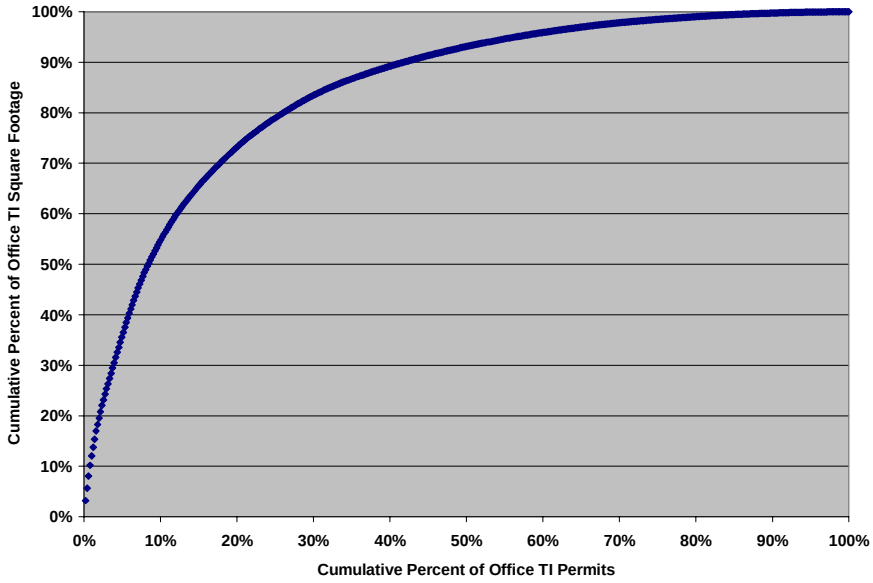

Figure 6-3. Distribution of Square Footage for Permits Issued by City of Irvine for Office Tenant Improvements

6.6 NONRESIDENTIAL A&A IN THE CITY OF SACRAMENTO

Data on the value of commercial permits issued by the City of Sacramento were tabulated to show the distribution of value by type of building and by A&A activity. This tabulation is shown in Table 6-7.

- Out of a total valuation of about $109 million for commercial permits for alterations or additions to nonresidential buildings, 62.3 percent was for alterations or additions to office/bank/professional buildings. Retail buildings accounted for 12.6 percent and industrial buildings for 11.3 percent.
- General alteration and addition activity accounted for 49.5 percent of the total valuation, remodeling activity for 31.9 percent, and tenant improvements for 18.7 percent.

Table 6-7. Value of Commercial Permits Issued by City of Sacramento during 2000 Classified by Type of Building and Type of Construction Activity (Value in Dollars)

Type of Building	***Type of A&A Activity***			***Totals***
	General A&A	***Remodeling***	***Tenant Improvement***	
Office/bank/professional	26,116,504	22,873,851	18,740,876	67,731,231
Retail	7,059,423	5,343,885	1,316,383	13,719,691
Industrial	10,845,141	1,355,595	56,175	12,256,911
Public works & utilities	6,824,125	2,684,213		9,508,338
Amusement/recreation	500,642	1,108,299	182,000	1,790,941
Structure other than building	1,186,087	36,300		1,222,387
Religious	432,684	257,599		690,283
Hotel/motel	262,162	379,562		641,724
Medical buildings	138,525	462,825		601,350
Service station/repair	218,845	134,900		353,745
Public parking	150,000			150,000
Educational	76,226	16,800		93,026
Other nonresidential building	16,450			16,450
Totals	53,826,814	34,653,829	20,295,434	108,776,078

6.7 SUMMARY AND CONCLUSIONS ABOUT BUILDING TYPE MARKET SEGMENTS

The various data examined in this chapter indicate that three types of nonresidential buildings 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. FACTORS INFLUENCING ENERGY-RELATED DECISIONS ON NONRESIDENTIAL R&R PROJECTS

This chapter presents and discusses information on the factors influencing energy-related decisions on the remodeling or renovating of nonresidential buildings. The data used were gathered through a telephone survey of 341 decision makers for remodeling or renovation projects throughout the state.[1] The sample is composed of decision makers from a random selection of projects drawn from permit data. Initially, we attempted to locate decision makers based on data from summary building permit information (169 cases). Because it was difficult to identify decision makers by this method, we switched to a method of determining who the decision makers were after obtaining Title 24 documentation at the building permit offices and then contacting them (172 cases). This made it easier to locate the decision makers.

7.1 CHARACTERISTICS OF THE DECISION MAKERS AND THEIR FIRMS

To better understand who the decision makers are, we asked respondents to describe their firm and provide their job title. Contractors were the largest group (42 percent) followed by real estate developers, building owners and other types of firms (Table 7-1). Architecture and engineering firms comprise 30 percent of firms surveyed. Thirteen percent of respondents work for real estate developers or commercial building owners and/or managers. Building owners with non-real estate related business comprise 10 percent of firms in this study.

Table 7-1. Type of Firm

Type of Firm	***Percent of Cases***
Contractor	42
Architecture/engineering	30
Real estate developer or commercial building owner/manager	13
Building owner with non-real estate related business	10
Some other type of firm	5
Total percent of cases	100
Total cases (N)	294

[1] The total number of responses do not add up to 341 when there are missing responses or when a subgroup is selected for analysis.

For the most part, those who responded to the survey were either owners or senior managers in the firms or senior project managers. Table 7-2 shows that engineering/architecture managers make up the largest grouping (28 percent) followed by construction managers (26 percent). Owners and partners comprise 19 percent of the survey respondents. Operation managers comprise 15 percent of the respondents. Senior officers comprise eight percent. Purchasing/administrative managers and other professions make up four percent.

Table 7-2. Job Title

Job Title	***Percent of Cases***
Engineering or architecture manager	28
Construction manager	26
Owner/partner	19
Operation manager	15
Senior officer	8
Purchasing/administrative manager or other job title	4
Total percent of cases	100
Total cases (N)	301

Table 7-3 shows how the respondents are distributed by type of firm and job title. Note that architects and engineers distribute across several types of firms. Fifty-eight percent of engineering/architecture managers are employed by engineering and/or architecture firms. Twenty-one percent of these managers are employed by real estate developers. Owners and partners work mostly for real estate developers (50 percent), followed by engineering or architecture firms (38 percent). Senior officers have a similar employer breakdown, working mostly for real estate firms (54 percent), followed by engineering or architecture firms (27 percent). Construction managers work primarily for real estate firms (67 percent). Operation managers work for contractors, real estate developers, or commercial building owners.

Table 7-3. Job Title by Type of Firm

Job Title	*Contractor*	*Architecture/ engineering*	*Real estate developer or commercial building owner/ manager*	*Building owner with non- real estate related business*	*Some other type of firm*	*Total cases (N)*
Owner/partner	2	38	50	10	0	50
Senior officer	5	27	54	5	9	22
Engineering or architecture manager	11	58	21	7	3	74
Construction manager	13	11	67	6	3	70
Operation manager	40	11	9	29	11	35
Purchasing/administrative manager or other job title	11	0	56	22	11	9

7.2 FOR WHOM IS REMODELING AND RENOVATION DONE?

Most commercial remodeling and renovation projects are completed in buildings occupied by firms leasing space.[2] Sixty-eight percent of the respondents indicated that the remodeling and renovation project that was the focus of the survey was completed in buildings occupied by lessees, three percent in buildings occupied by owners and lessees, and 29 percent in owner occupied buildings.

For those projects completed in leased space, respondents were asked for whom the project was completed. The results are reported in Table 7-4 In nearly 90 percent of the cases where the project was in leased space, the project was completed for the lessee. In the remaining 10 percent of the cases the project was completed for the developer or a commercial real estate firm.

Table 7-4. In Leased Space, for Whom Project Was Completed

For Whom Project Was Completed	*Percent of Cases*
Lessee who is using the space	86
Developer/commercial real estate firm that owns and leases	7
Lessee with a ground lease	4
Commercial real estate firm that does triple net leases	2
Other type of firm	<1
Commercial real estate firm that manages space for an owner	<1
Total percent of cases	100
Total cases (N)	203

[2] For our purposes, the term "tenant" is used broadly to mean an occupant whether owner or lessee. Throughout this document we will attempt to use the word lessee to refer to a tenant who leases space and let the word tenant refer to either an owner or lessee.

7.3 REASONS FOR REMODELING AND RENOVATING

Survey respondents were given a list of six reasons for remodeling or renovating a building and were asked what precipitated the remodeling and renovation activity for the building identified in the survey. Respondents could give more than one response. The most commonly cited motivation (81 percent of cases, Table 7-5 Column 1) was to alter space to account for changes in tenancy or tenant operations. Additional reasons include a general updating of the building (46 percent of the cases) or 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. Very few respondents gave other reasons.

Table 7-5. Reasons for Undertaking Most Recent Remodeling and Renovation Project

Reason for Undertaking R&R Project	***Percent of Cases[1]***	***Percent of Responses***
Alter space to account for changes in tenancy or tenant operations	81	40
Generally update the building to replace aging equipment, extend the life of the building or freshen a building's look without changing the class of a building	46	23
Upgrade the quality and/or the functionality of space in order to change the class of the building and/or increase its lease value	37	19
Finish previously unfinished space	16	8
Change the space from one use to a completely different one	15	8
Some other goal	5	3
Total percent of responses		100
Total cases/responses(N)	332	675
Total responses (N)		675

[1] Because respondents could give more than one answer the percentages in this column add to more than 100. There were nine cases for which no data were available.

The key finding is that a change in tenant and/or a tenant changing their operation drives the remodeling and renovation market. If program implementers want to capture this 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. Such firms are likely to be aware of space that is coming to market in sufficient time to allow energy efficiency program managers to promote energy efficiency when changes to space are being made. It might be worthwhile to identify and work with some of the larger leasing agents.

Respondents often indicated multiple reasons for renovating and remodeling buildings. Therefore, we examined the reasons for modifying buildings 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 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.

7.4 TENANT TURNOVER

Measure life and other studies have suggested the turnover rate among tenants is high, with many tenants occupying remodeled space for as little as one to two years. However, the respondents interviewed for this study reported (Table 7-6) that tenants are likely to continue to occupy the 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.

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. However, the simple return on investment for a six-year payback is 16 percent. In other studies that we have done, most businesses have indicated that they are interested in returns on investment that are higher than 16 percent. 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.

Table 7-6. Length of Time Firm for Whom Renovation Was Done Is Likely to Hold the Space

Length of Time Occupant Likely to Hold Space	***Percent of Cases***
Three years or less	8
Four or five years	15
Six years of more	77
Total percent of cases	100
Total cases (N)	269

7.5 TYPES OF SPACE THAT ARE RENOVATED

Once renovated, space is most likely to be used for offices, followed by retail, warehouse, industrial and other uses. Table 7-7 shows the percentage uses for the 341 buildings in the sample. Because some buildings have more than one use the total is greater than 100 percent.

Office uses are clearly dominant by a factor of more than 2.5 to one. About ten percent of the remodeling projects involved buildings that were used for warehouses and industrial uses after renovation.

Table 7-7. Building's Use after Remodeling or Renovation

	Percent of Cases[1]	***Subtotals***
Office space		54
Low-rise office space	37	
Mid-rise office space	9	
High-rise office space	8	
Retail space		22
< 10,000 square feet	12	
10,000 to 25,000 square feet	4	
> than 25,000 square feet	6	
Warehouse	9	9
Industrial	9	9
Other	7	7
Restaurant	4	4
School	2	2
Religious worship	1	1
Total cases (N)	341	100

[1]Buildings may have more than one use and thus percentages add to more than 100 percent.

About twelve percent of the respondents reported multiple uses of the space subsequent to the renovation. As can be seen in Table 7-8, nearly 67 percent of the combinations are offices combined with other functions. Another quarter of the combinations are retail with some functional use of space for other than offices. About a fifth of the combinations that involve office space have retail space as the other function while about half of the office combinations are associated with changes to industrial and warehouse space. Retail and restaurants are the other combination of note.

Table 7-8. Combinations of Uses in Buildings Having More Than One Use Subsequent to Renovation

Type of Use	***Number of Cases***
Office and other combinations	
Office and retail	6
Office, warehouse and industrial	6
Office and warehouse	4
Office and industrial	4
Office and laboratory	2
Office and school	1
Office and residential	1
Office, restaurant, and public assembly	1
Office and public assembly	1
Office, retail and warehouse	1
Retail and non-office combinations	
Retail and restaurant	4
Retail, warehouse and industrial	1
Retail and school	1
Retail and warehouse	1
Retail and other	2
Warehouse and industrial	2
Industrial and other	1
Religious worship	1
Total cases (N)	40

About 15 percent of the respondents (49 cases) 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 the 49 cases, it appears that space had multiple uses prior to the renovation and the changes to the spaces represented a change from one type of pre-existing usage to another type of pre-existing usage, for example, a shift to more office space in an office - warehouse combination. For about two-thirds of the cases (33 cases) there is a reported change 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.

7.6 INTERIOR SPACES ARE THE FOCUS OF REMODELING ACTIVITIES

Remodeling and renovation projects are focused on interior spaces. A majority of respondents (70 percent) reported that their project involved substantial changes to the interior. Another 10 percent reported that their project involved substantial changes to the interior and exterior of the building and only three percent indicated that their project involved substantial changes to the exterior. When combined, the latter two categories suggest that projects that result in substantial changes to exteriors represent about 13 percent of all projects. Approximately one sixth of the respondents reported that their projects did not involve substantial changes to either the interior or the exterior.

We examined the dollars spent on the project and the square footage of the project for those who reported no substantial changes to the interior or exterior. Those who reported no substantial changes to the interior or exterior were doing low budget projects, projects with small amounts of floor space, or both. Thus, our respondents took us literally when we said "substantial." Almost all of the respondents who reported their projects were not substantial, were doing interior only projects.

7.7 WHO PRODUCES THE DESIGNS?

Table 7-9 shows information regarding who produces the design for remodeled or renovated space. Eighty percent of the respondents said that an architect was involved in the remodeling. In 46 percent 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. Contractors and subcontractors were the least likely to be primarily responsible for producing the renovation designs and specifications (two percent). Many owners tell us that they have in-house staff with design experience who hire design expertise. Thus, we were somewhat surprised that thirty-one percent of the design was being done by the owner or in-house planning and design staff. Our impression from other studies is that lessees do not play a major role in remodeling and renovation. However, 16 percent of the respondents report that the lessee or the lessees architect was primarily responsible for producing designs and specifications.

Table 7-9. Primary Responsibility for Producing Designs and Specifications for the Renovation

Who Was Responsible for Designs/Specifications?	Percent of Cases
Architect and/or associated consultants hired by the owner or developer	46
Owner or developer's in-house planning and design staff	31
Lessee and/or the lessee's architect	16
General contractor who used its own staff and/or consultants	5
Contractor and/or subcontractors using their own staff and/or consultants	2
Total percent of cases	100
Total cases (N)	329

There is some variation by whether the remodeled structure is occupied by the owner or the lessee (see Table 7-10). The remodel designs for lessee and 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 tenant occupied spaces. The tenants' architect is involved in about 20 percent of lessee occupied remodels.

Table 7-10. Who Does the Design Work by Type of Tenancy

Who Does Design Work?	Percent by Type of Tenancy		
	Owner occupied	Lessee Occupied	Owner/ tenant occupied
Architect and/or associated consultants hired by the owner or developer	46	47	40
Owner or developer's in-house planning and design staff	45	25	40
Lessee and/or the lessee's architect	4	20	
General contractor who used its own staff and/or consultants	2	6	
A contractor and/or subcontractors using their own staff and/or consultants	3	2	
Total percent of cases	100	100	100
Total cases (N)	92	220	10

7.8 BUDGET SETTING

The budget is the key determinant of what can and cannot be done in a 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.

When asked who is primarily responsible for determining the overall budget, 75 percent of the respondents indicated that it was the owner or the owner's staff (Table 7-11). The lessee or lessee's architect is primarily responsible for determining the budget in 13 percent of the cases. The data show that lessees are much more likely to have budget responsibility for retail spaces than for office spaces. Lessees are responsible for the budget in 21 percent of retail settings but only 12 percent of office settings. A typical example of this is a chain store or franchise that leases space and then uses its own image architect to develop the plans for the space.

In about eight percent of the cases, owners indicated that they worked with developers, architects or contractors to establish a budget. In only about two percent of cases does it appear that developers mostly determine the budget.

Table 7-11. Primary Responsibility for Determining Overall Base Budget for the Renovation

Who Was Responsible for Determining Base Budget	*Count of Cases*	*Percent of Cases*
Owner and/or the owner's staff	193	74
Lessee and/or the lessee's architect	33	13
Owner with input from an architect and/or contractor	16	6
Consultant or consulting architect working for the owner/developer	6	2
Owner in consultation with investors or bankers	6	2
Developer and/or the developer's staff	5	2
Other	3	1
Total percent of cases		100
Total cases (N)	262	

7.9 SOURCES OF INFORMATION

If energy efficiency program implementers are to be effective, they need to know something about the channels through which decision makers receive information. Accordingly, sources of information for decision makers were examined for remodeled buildings where the lighting and HVAC systems were changed. Both groups indicated that they obtained most of their information from other building professionals.

Most of the respondents (75 percent) who reported substantial changes to lighting systems during remodeling, reported that information came from a single source. Just about half of the respondents said that they obtained information from electrical engineers (Table 7-12, Column 3). Much less frequently, five to 13 percent of the time, they identified other professionals such as lighting designers, architects, consultants, and consulting engineers as sources of information. We have included contractors among building professionals because electrical contractors often have electrical engineers on their staff. However, we note that contractors represent only eight percent of the total sources cited.

If we examine where information came from in terms of all sources (Table 7-12, Column 2), 71 percent of the sources were external professional sources. Nineteen percent of the information came from internal sources. The internal sources 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.

Table 7-12. Sources of Information about Lighting Improvements Used in Remodeling or Renovating

Source of Information	***Percent of Responses***	***Percent of Cases***
External building professionals		
Electrical engineers	40	49
Lighting designers	10	13
Architects	9	11
Contractors	8	9
Consulting engineers	4	5
Internal sources		
Internal maintenance staff	10	13
Internal design staff	9	11
Other sources		
Distributors or dealers	3	4
Tenants	3	3
Utilities	2	3
Trade publications	1	1
Owners	1	1
Total percent of responses	100	
Total cases (N)		236
Total responses (N)	290	

A similar analysis was completed for information received by respondents in buildings where remodeling and renovation included changes in HVAC equipment and design (Table 7-13). 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. Unlike respondents making lighting changes, respondents making HVAC changes (44 percent) are much more likely to use contractors as a source of information than 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.

Table 7-13. Sources of Information about HVAC Equipment and Designs Used in Remodeling or Renovating

Source of Information	***Percent of Responses***	***Percent of Cases***
External building professionals		
HVAC contractor	36	44
HVAC consultant	25	30
Engineering firm	16	19
Internal sources		
Internal maintenance staff	19	23
Other		
Distributors	2	2
Manufacturers	2	2
Total percent of responses	100	
Total cases (N)		108
Total responses (N)	129	

These data indicate that building professionals are the key conduit for the lighting and HVAC information 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.

7.10 CRITERIA USED IN DECISION-MAKING

A review of prior studies identified a number of criteria that respondents might apply to decision making about lighting and HVAC systems. Respondents who made substantial changes to lighting systems were asked to rate eight criteria that they may have taken into account when making decisions. Table 7-14 shows the average importance respondents attached to these criteria based on a 1 to 10 scale where 1 is not at all important and 10 is very important.

On average, all items are viewed as having some importance, that is, a score of 5.0 or better. Title 24 (with a mean score of 8.7) 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.

Table 7-14. Important Factors When Making Substantial Changes to Lighting Systems

Factor	***Mean***	***Standard Deviation***	***N***
Title 24 requirements	8.7	1.8	195
Improved lighting quality	7.9	1.6	199
The energy efficiency of an item	7.8	1.6	199
High equipment reliability	7.5	1.8	199
An acceptable payback from energy savings	7.2	2.3	180
The ability to recapture the cost of an item in the lease	6.9	2.0	140
Prior experience with the equipment	6.8	2.3	181
Price or the first cost of an item	6.7	2.0	197

People may mix and match these criteria in a variety of ways. Thus, it is useful to explore how these criteria relate to each other. This can be done using a technique called factor analysis. 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.

When these eight variables were subjected to a factor analysis, three factors emerged that explain 58 percent of the total variance within the data. Table 7-15 shows the factor loadings for each of the three variables. In order to aid in the interpretation, the cells with high loadings have been shaded with gray. Coefficients range from –1 to 1. Coefficients with negative signs indicate that a positive value of the variable tends with a negative value of the factor or vice versa.

Table 7-15. Results of Factor Analysis for Changes to Lighting Systems

Factor	Factor 1	Factor 2	Factor 3
	Payback, reliability and cost	Title 24 energy efficiency sensitive	Title 24 cost and payback sensitive
Title 24 requirements	0.251	0.624	0.539
Improved lighting quality	0.466	0.274	-0.341
Energy efficiency of an item	0.149	0.664	-0.092
High equipment reliability	0.567	-0.063	-0.319
Acceptable payback from energy savings	0.662	-0.445	-0.302
Ability to recapture cost of an item in the lease	0.655	-0.212	0.462
Prior experience with the equipment	0.576	0.426	-0.250
Price or the first cost of an item	0.560	-0.285	0.464

It is customary to examine the variables with high loadings on each factor and then to assign a name to the factor.

- The first factor is a "payback and reliability factor." 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. 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."
- The second factor, which we designate as the "Title 24 efficiency sensitive group", 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, which we designate 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 payback. Notice 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 about what may have prevented them from making changes to the lighting system (Table 7-16). As with the preceding items, these items were rated on a 1 to 10 scale where 1 was not at all important, a 5 was neither important nor unimportant, and a 10 was very important. For the most part, these ratings are near the middle of the scale suggesting that lighting, or at least these reasons for making a decision about lighting, were not terribly important.

Table 7-16. Factors Important in Preventing Lighting-Related Energy Efficiency Improvements

Factor	Mean	Standard Deviation	N
Lighting was already efficient	6.9	2.8	59
Initial cost of energy efficiency improvements	6.4	2.9	49
Low or nonexistent payback from making energy efficiency improvements	5.4	3.0	45
Inability to recover the cost in lease rates	5.2	2.9	43
Lack of knowledge of energy efficiency options	4.5	2.7	43
Lack of experience with energy efficient lighting	4.5	2.6	42
Concerns about the reliability of efficient lighting	4.1	2.7	44

Respondents who did not make substantial changes to lighting were asked if they would have been very likely, somewhat likely, or not very likely to choose more efficient lighting if offered various incentives. The three response types were then recoded into numeric values of one, two, and three, respectively, where one was very likely and three was not very likely. All of the responses were between two and three suggesting that none of these interventions would have made a difference (Table 7-17).

Table 7-17. Likelihood of Choosing More Efficient Lighting If Offered Different Incentives

Type of Incentive	Mean	Standard Deviation	N
Informational seminars on lighting	2.8	0.5	55
Free technical assistance for lighting	2.8	0.6	54
Opportunity to obtain efficient lighting equipment through a multi-year contract with a third party that allows you to payback the cost through savings	2.7	0.6	43
Low interest loan to make improvements	2.5	0.7	59
Rebate on the equipment purchase price	2.5	0.7	58

A similar analysis of the criteria that influence HVAC decision-making was completed. These results are reported in Table 7-18. 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.

Table 7-18. Important Factors in Influencing Decisions about Improvements for Building's HVAC System

Factor	Mean	Standard Deviation	N
Title 24 requirements	8.9	1.6	117
Improved tenant comfort	8.1	1.8	119
Energy efficiency of an item	7.8	1.6	124
High equipment reliability	7.7	1.7	126
Price or the first cost of an item	7.1	1.8	123
Acceptable payback from energy savings	7.1	2.3	111
Prior experience with the equipment	6.8	2.4	110
Ability to recapture the cost of an item in the lease	6.5	2.2	85

As with the lighting, a factor analysis was completed for the HVAC decision criteria. As reported in Table 7-19, the analysis produced three factors that explain 30, 19 and 13 percent of the variance respectively.

- After examining the factors, the first factor is termed an efficiency, comfort, and reliability factor. 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 is about 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.

Table 7-19. Results of Factor Analysis for Changes to HVAC Systems

Factor	Factor 1 Efficiency and comfort savings and cost	Factor 2 Cost and experience	Factor 3 Title 24 cost and cost insensitivity
Title 24 requirements	0.470	-0.236	0.716
Improved tenant comfort	0.622	-0.147	-0.237
Energy efficiency of an item	0.729	-0.416	0.185
High equipment reliability	0.575	-0.508	-0.211
Acceptable payback from energy savings	0.586	0.413	-0.305
Ability to recapture the cost of an item in the lease	0.275	0.745	0.218
Prior experience with the equipment	0.474	0.523	0.276
Price or the first cost of an item	0.537	0.192	-0.401

We asked respondents who did not make any changes to their HVAC system why they did not change the system. Table 7-20 shows that 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.

The same respondents were 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. Table 7-21 shows the results based on a scale of one to three where one is very likely and three is not very likely. All of the marketing incentives have an average score of between two and three. This means that none of these marketing incentives is likely to have resulted in an increased interest in increasing the efficiency of an HVAC system.

Table 7-20. Factors Important in Preventing Energy Efficiency Improvements to a Building's HVAC System

Factors Preventing Energy Efficiency Improvements to HVAC	Mean	Standard Deviation	N
HVAC system already efficient	7.3	2.2	120
Having to meet Title 24 or permitting requirements if the system were changed	7.1	2.4	96
Cutting costs	6.4	2.4	104
Concerns about reliability	6.3	4.0	18
Lack of knowledge of energy efficiency options for HVAC systems	5.8	2.1	95
Having no enhanced value in the space if changed	5.8	2.1	93
Low or nonexistent payback from making energy efficiency improvements	5.5	2.2	97
Initial cost of energy efficiency improvements too high	5.5	2.2	98
Lack of experience with energy efficient improvements for HVAC systems	5.4	2.2	88

Table 7-21. Likelihood of Modifying HVAC System If Offered Different Incentives

Type of Incentive	Mean	Standard Deviation	N
Low interest loan to make improvements	2.4	0.7	127
Rebate on the equipment purchase price	2.5	0.7	126
Opportunity to obtain efficient HVAC system equipment through a multi-year contract with a third party that allowed you to payback the cost through savings	2.6	0.7	95
Free technical assistance	2.7	0.6	100
Information seminars	2.7	0.6	114

7.11 ROLE OF VALUE ENGINEERING

In order to meet a budget, it is sometimes necessary to reduce the complexity of proposed systems or substitute less costly components while maintaining basic functionality. This is often referred to as value engineering. There is some irony in the way the term is now used because it was initially used to describe attempts to increase the functionality of systems for the same value. From an energy efficiency standpoint, the concern with value engineering is that the value engineering process may result in reducing the planned efficiency of buildings

when addressing cost and budget concerns in the late stages of a project after the budget has been fixed.

First, respondents were asked if their project was subject to value engineering to see if value engineering was fairly common. Results indicate that 25 percent of all projects were subject to value engineering.

Table 7-22 shows the distribution of systems that are most commonly subjected to value engineering in three ways. If we first consider just 82 projects where value engineering occurred, column two tells us the frequency with which each type of system was the focus of value engineering for those 82 projects. Thus, in 63 percent of the projects where value engineering occurred, the lighting system was the target of value engineering. The table also shows us that when we consider projects where value engineering occurred, HVAC components, the HVAC distribution system, and the power system were also frequent targets of value engineering activities.

Because changes might be made to the lighting system, the HVAC system, and other systems in response to budget pressures for a given project, the percentages in Column 2add to more than 100. It is clear that when value engineering occurs, more than one system is usually affected. On average, it appears about three systems are affected when value engineering occurs.

Some systems are changed more often than others in remodeling and renovation projects. While this topic is discussed in detail in Chapter 8, some examples are useful here. Lighting systems and HVAC systems are changed most frequently (76 percent and 72 percent respectively), while power distribution components are changed about 27 percent of the time. Thus, another way of looking at value engineering is to consider how often value engineering occurs when the specific system was changed, for example, the lighting system. (Table 7-22, Column 3). What we see when we examine Column 3 is that if the shell of a building is changed (about 31 cases out of the total of 341 respondents) then there is a very high likelihood that value engineering will occur, 72 percent of the time. Contrast this with the fact that value engineering occurs in about 20 percent of all cases where the lighting system was changed.

It appears that when changes are made to HVAC system components and power distribution systems, they are more often the target of value engineering than lighting systems (e.g., 20 percent for lighting compared to 28 percent for other two). When lighting, HVAC, and power distribution systems are changed, they are subject to value engineering from 20 to 25 percent of the time.

Finally, we can see the percentage of times each type of system is subjected to value engineering as a percent of all projects (Column 4). For each type of system

and for all projects, value engineering occurs between three and 15 percent of the time. At first blush, this may seem inconsistent with our finding that 25 percent of all projects are subject to value engineering. However, for projects where value engineering occurs, an average of three systems are affected. Thus, there is no inconsistency.

Table 7-22. Building Components Subject to Value Engineering

Building Component	***Percent of systems affected when project is subject to value engineering***	***Percent of systems value engineered as percentage of systems remodeled***	***Percent of all systems subject to value engineering as a percent of all projects***
Lighting	63	20	15
HVAC system components	54	28	13
HVAC distribution system	53	18	13
Power distribution system and infrastructure	43	28	10
Shell structure, ornamentation and facade elements	28	72	7
External windows and doors	20	24	5
Roof system	17	41	3
Cases for column percent (N)	82	82	341

[1]Buildings may have more than one use and thus percentages add to more than 100 percent.

For lighting and HVAC system components, we asked how value engineering was expressed in terms of modifications to the system. For lighting, Table 7-23 shows that the most common response (63 percent) was replacing fewer fixtures which presumably means retaining older fixtures. Slightly more than a third of the respondents reported using less efficient fixtures or reducing the number of controls.

Table 7-23. Changes in Lighting Resulting from Value Engineering

Change in Lighting	***Percent of Responses***	***Percent of cases where lighting was subject to value engineering***
Replacing fewer fixtures	47	63
Using less efficient fixtures	28	38
Reducing the number of controls	26	34
Total percent of responses	100	
Total cases (N)		32
Total responses (N)	43	

The results for HVAC systems are reported in Table 7-24. Replacing fewer components was the most frequently cited result of subjecting HVAC system components to value engineering followed by reducing the number of zones, reducing the number of controls, using less efficient components, and minimizing changes to the distribution systems the least frequently utilized.

Table 7-24. Changes in HVAC System Resulting from Value Engineering

Changes in HVAC System	***Percent of Responses***	***Percent of cases where HVAC was subject to value engineering***
Replacing fewer components	33	54
Reducing the number of zones	20	32
Reducing the number of controls	16	25
Using less efficient components	16	25
Minimizing changes to the distribution systems	16	25
Total percent of responses	101	
Total cases (N)		28
Total responses (N)	45	

In summary, value engineering is practiced in about a quarter of remodeling and renovation projects. In comparison to other systems, the lighting system is the system that is most frequently subject to value engineering. However, when normalized for the number of each type of system that is modified during remodeling and renovation activities, a higher percentage of exteriors and roofs are the focus of value engineering. This seems to suggest that decision-makers can find ways to reduce what is done with these systems that does not affect the building. At least one roofing contractor with whom we talked indicates that he does many partial roofing jobs, suggesting that salvaging the existing roof is a frequent response. Changes to external features of the building can be dropped without affecting the functional operation of the building. HVAC and power distribution systems are the next most frequently changed systems. This may be because of the cost of the components and other changes to these systems.

When value engineering is done for HVAC and lighting systems, the most common response seems to be to salvage the existing hardware. Reducing the efficiency of equipment and the number of controls are also used to control costs.

7.12 SUMMARY AND CONCLUSIONS

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.

This suggests that those who want to target buildings that are to be renovated or remodeled should track which spaces are likely to turn over. 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.

The literature, especially the literature on measure life, suggests that there is a high turnover rate in commercial space. However, respondents in our survey report 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.

Office spaces were most commonly remodeled or renovated followed by retail spaces. Most remodeling and renovation activities are focused on the interior. Fewer than 13 percent of the respondents reported that their project involved substantial changes to exteriors.

An architect was involved in 80 percent of all of the remodeling and renovation activities. About half the time the architect was an outside consultant. About a third of the time the architect was a part of the owner or developers in-house staff. One third of the time the architect worked for the lessee. This means that the developer's staff and the lessee's staff, for example, the design staff for retail chains, as well as commercial architects, are important targets for energy efficiency information.

Budgets are set by the owner about 75 percent of the time. The lessee's architect determines the budget in about 15 percent of the cases. While the owner may not be directly involved in detailed decision-making, it is clear that owners set the constraints and that they may become involved in making trade-offs among amenities such as marble in the lobby or a more efficient HVAC system.

Respondents were asked where they obtained the information on which they based their decisions. Lighting decisions were heavily influenced by external building professionals, especially electrical engineers. Internal design or maintenance staff were reported to have influence in about a quarter of the cases. . Other sources of information such as utilities or distributors were cited infrequently.

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 were consulted more often in HVAC

decision-making than in decision-making about lighting. Manufacturers and distributors appear to influence only a few players.

These two sets of findings show the importance of external professionals in decision-making. In the case of HVAC decisions, the internal maintenance professionals sometimes play important roles. It also shows that influence is seldom attributed to manufacturers and distributors.

We asked respondents to rate a set of criteria that might be used in decision-making. For lighting, they reported that Title 24 requirements, improved lighting quality, energy efficiency and equipment reliability were the most important criteria. When we examined the data more closely we were able to discern three general factors that affect lighting decision-making. For some people, payback, reliability, and cost are most important. For another group, Title 24 and sensitivity to energy efficiency are the most important criteria. For a third group, Title 24, cost, and payback are the most important. What these last two groupings show is that people respond to Title 24 in different ways. Some respond to it in terms of energy efficiency and some respond to it in terms of the costs that it may impose.

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. We also found that 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, Title 24 requirements, improved tenant comfort, energy efficiency, and equipment reliability, are similar to those for lighting. When we look at the general factors we find three groups of people: 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 factors 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 reasons why they did not install efficient HVAC systems. Some reported 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.

In general, these findings suggest that 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.

Earlier we pointed out that the owners set the budget which then forms a constraint within which other decisions are made. The process by which trade-offs are made is often called "value engineering." 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 lighting systems are 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. We see a similar pattern with HVAC systems 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.

8. ENERGY-RELATED TECHNOLOGIES INSTALLED DURING R&R OF NONRESIDENTIAL BUILDINGS

The analysis in Chapter 4 showed a statistical relationship at the aggregate level between remodeling and renovating of nonresidential buildings and decreases in electricity use for such buildings. The purpose of this chapter is to provide information on the characteristics of energy-related technologies (e.g., lighting, HVAC) that are installed during remodeling and renovating to decrease electricity use.

8.1 DATA COLLECTION PROCEDURE

The information reported here on the characteristics of energy-related technologies (e.g., lighting, HVAC, etc.) that are installed during the remodeling and renovating of nonresidential buildings was collected not only from telephone or in-person interviews (as discussed in Chapter 7), but also from Title 24 documentation that is filed with the building permits for the remodeling or renovating activity. A more extended discussion of the procedure used to collect Title 24 documentation is provided in Appendix A. However, some important features of this data collection procedure need to be pointed out here.

8.1.1 Collecting Title 24 Documentation

An effort was made to collect data on the characteristics of remodeled or renovated space for a sample of 300 commercial premises from the Title 24 documentation that is filed with permit applications for buildings. Data collection visits to collect this Title 24 documentation were made to 50 building permit offices throughout the state, resulting in Title 24 documentation for 301 buildings. The numbers of buildings for which Title 24 documentation was obtained for each office are shown in Table 8-1.

Building permits are public records and are supposed to be open to inspection. In fact, however, accessibility to the records varied across permit-issuing offices. No department indicated that obtaining data from the Title 24 documentation was prevented. However, the ease with which the data could be accessed did vary. Some locales (e.g., City of Los Angeles, San Leandro, Santa Ana) do not preserve Title 24 documentation. Once a permit is finalized, the Title 24 documentation is disposed of. Other departments send the Title 24 documentation for microfilming or archiving a fairly short time after the final occupancy certificate is issued. While the documentation could be accessed, it required going back to microfilm or microfiche records. Because of these constraints, the amount of information that could be collected on the characteristics of the lighting and HVAC for the remodeled or renovated areas at the sample sites varied.

Table 8-1. Permit-Issuing Offices from Which Title 24 Documentation Was Obtained

Place	*Title 24 Documents*	*Place*	*Title 24 Documents*
Adelanto	3	Palm Desert	4
Anaheim	4	Palo Alto	3
Beverly Hills	4	Pasadena	6
Brisbane	3	Poway	5
Burlingame	3	Redwood City	3
Carlsbad	3	Rolling Hills Estates	5
Carson	3	Roseville	4
Commerce	8	Sacramento	6
Costa Mesa	4	San Diego	17
Cypress	2	San Francisco	17
Downey	4	San Jose	13
El Segundo	2	San Leandro	5
Folsom	5	Santa Ana	7
Fremont	3	Santa Clara	3
Fresno	5	Santa Monica	3
Hayward	5	Sunnyvale	10
Irvine	4	Torrance	6
Los Angeles	29	Tulare	3
Marina	3	Vacaville	6
Milpitas	7	Vista	2
Monterey	5	Los Angeles County, Unincorporated	23
Mountain View	8	Orange County, Unincorporated	1
Newport Beach	5	Sacramento County, Unincorporated	7
Oakland	9	Santa Clara County, Unincorporated	5
Ontario	1	Sonoma County, Unincorporated	5

The distribution by business type for the sites for which Title 24 documentation was collected is shown in Table 8-2. As can be seen, office and retail premises accounted for most of the sampled premises. Over half of the sampled premises were offices, while just over 20 percent were retail premises. This distribution of sampled premises accords with the evidence presented in previous chapters that showed that offices and retail stores account for most of the remodeling and renovating of nonresidential buildings.

Table 8-2. Distribution by Building Type of Sites for Which Title 24 Documentation Was Collected

Type of Building	Number for Which Data Collected	Percent of Surveyed Sites
Office	179	57.6%
Retail	64	20.6%
Industrial	14	4.5%
Warehouse	14	4.5%
Restaurant	8	2.6%
Public assembly	6	1.9%
School	5	1.6%
Religious worship	4	1.3%
Services	2	0.6%
Other	8	2.6%
N/A	7	2.3%
Total	311	100.0%

8.1.2 Verifying Title 24 Documentation

Follow-up on-site visits were made to a subsample of 100 premises for which Title 24 documentation had been obtained to determine whether the premise as altered matched the information contained on the Title 24 documentation. The results of these verification visits are shown in Table 8-3. For some of the sites with HVAC equipment, verification was not possible because access to the equipment was not possible. These are reported as not being verified, which lowers the reported percentage verified. Overall, the verification visits showed that the equipment reported on the Title 24 documentation as going to be installed was indeed installed.

Table 8-3. Results of On-Site Verification Visits

	HVAC	Lighting
Number of sites visited	56	86
Sites at which equipment verified	49	83
% of sites at which equipment verified	87.5%	96.5%

8.2 SYSTEMS AFFECTED BY REMODELING AND RENOVATION

During the telephone interviews, respondents were asked which systems were most commonly subject to substantial changes during remodeling and renovation. The responses are tabulated in Table 8-4. The lighting system was the system most frequently mentioned, followed by the HVAC distribution system, interior partitions, and HVAC components. Changes to exterior elements occurred less than 20 percent of the time. The most common changes to exterior elements were

to windows although our data suggest that some window changes are related to interior rather than exterior changes.

When combinations of changes were examined, we found that lighting changes were likely to be accompanied by changes in the HVAC distribution system 85 percent of the time and by changes in interior layout 69 percent of the time. Changes to lighting that were combined with changes to the HVAC distribution system occur with changes in layout about 64 percent of the time.

Table 8-4. Building Components Substantially Changed during Remodeling or Renovating (per Telephone Interviews)

Building Component Changed	***Percent of Cases***
Interior Components Changed:	
Lighting	76
HVAC distribution system	72
Interior partitions	60
HVAC components	46
Power distribution system and components	37
Exterior Components Changed:	
External windows, skylights and doors	19
Roof system	10
Shell structure, ornamentation and façade elements	9
Total cases (N)	341

8.3 CHANGES TO LIGHTING SYSTEMS

Both the telephone interviews and the Title 24 documentation provide information with which to describe changes made to lighting systems in remodeled or renovated buildings.

8.3.1 Changes to Lighting Systems Reported by Interviewees

As shown in Table 8-4, 76 percent of the interviewees reported making lighting changes. For this group that made lighting changes, 86 percent of those making the changes (representing 65 percent of all respondents) said that they improved the energy efficiency of the system.[1] We also asked those who changed the

[1] Percentages reported here and in the following discussion are calculated against two bases: the number of interviewees who made changes and the total number of interviewees. For example, Table 8-4 shows that 76 percent of the interviewees made lighting changes. These 76 percent represented 65 percent of all interviewees (i.e., .76 x .86 = .65).

lighting system if they reused fixtures or replaced them. If fixtures are reused, we hypothesized that it is less likely that the energy efficiency of the lighting system would be improved.

Of those who changed the lighting system, about a fifth (22 percent, representing 16 percent of all interviewees) said that they reused existing lighting fixtures. Most of the remainder said that they replaced fixtures. (About 10 percent did not respond.) We asked if the systems were more efficient after they were replaced. Ninety-eight percent of those who replaced lighting fixtures and 83 percent of those who reused fixtures said that the systems were more energy efficient after the remodeling and renovation.

Thus, whether fixtures are replaced or re-used, the vast majority of those making changes to lighting systems believe that the systems are more efficient after they are changed. Even though a significant majority of those who reuse fixtures believe that systems are more efficient, this percentage is still statistically significantly less than the percentage who replace fixtures and believe that the system is more efficient. Those who reuse fixtures might be a target for a program opportunity. In the final analysis, the percentage of those who reuse fixtures and do not believe that they improved the efficiency of the lighting system is probably not sufficiently large to warrant action. Because we do not have the physical data, we do not know if the systems that are believed to be more efficient actually are more efficient.

Finally, we note that of those who said they made changes to lighting, about a quarter (representing about 18 percent of all interviewees) said that they had installed skylights and daylighting controls to supply light in work areas. However, whether this equipment was installed as part of the remodeling or renovation project or as a separate project was not indicated.

8.3.2 Characteristics of Lighting for Remodeled or Renovated Sites Reported in Title 24 Documentation

From the overall set of 311 sites for which Title 24 documentation was reviewed, there were 160 sites where information on lighting changes was reported. For these premises, the lighting installed as a result of the remodeling or renovation was primarily fluorescent (71.6 percent of installed wattage), incandescent (19.0 percent of installed wattage), and compact fluorescent (4.3 percent of installed wattage). Most of the fluorescent lighting was T8 fluorescent, which alone accounted for 59.1 percent of the installed wattage for the sample of sites with lighting changes.

Within the sample of sites with lighting changes reported in the Title 24 documentation, the distributions by type of lighting are somewhat different between office and retail premises.

- For offices, lighting in the remodeled or renovated premises was distributed among fluorescent (80.1 percent of installed wattage), incandescent (7.1 percent of installed wattage), and compact fluorescent (6.5 percent of installed wattage). Most of the fluorescent lighting was T8 fluorescent, which alone accounted for 56.0 percent of the installed wattage for the sample offices.
- For retail stores, lighting in the remodeled or renovated premises was distributed among fluorescent (63.6 percent of installed wattage), incandescent (32.0 percent of installed wattage), and compact fluorescent (0.6 percent of installed wattage). Most of the fluorescent lighting was T8 fluorescent, which alone accounted for 61.8 percent of the installed wattage for the sample retail premises.

A question underlying the analysis of energy efficiency for remodeled or renovated premises is whether equipment installed when changes are made is different than that installed during new construction of a premise. To address this question with respect to lighting, the percentages for types of lighting that were calculated for remodeled and renovated office and retail space are compared in Table 8-5 to similar percentages calculated by RLW Analytics from data they collected for the Nonresidential New Construction (NRNC) baseline database.[2] While the percentage distributions for office space are fairly similar, the distributions for retail space are different. As can be seen, the difference for retail space is mainly attributable to differences between the two data sets in the percentage of connected load accounted for by metal halides.

Table 8-5. Comparison of Percentages of Connected Load Accounted for by Different Types of Lighting for Office and Retail Space in NRRR and NRNC Samples

Type of Lighting	***Office Space***		***Retail Space***	
	NRRR Sample	***NRNC Sample***	***NRRR Sample***	***NRNC Sample***
Fluorescent	80.1%	87.7%	63.6%	48.3%
Incandescent	7.1%	4.0%	32.0%	14.4%
Compact Fluorescent	6.5%	5.4%	0.6%	0.8%
Metal halides	0.4%	0.6%	1.2%	34.5%

[2] RLW Analytics, Inc., *Nonresidential New Construction Baseline Follow-On Study: Project 1, Calculation of End Use Savings of Existing Data and Analysis of New LPD Baseline, Final Report,* November 2000, p. 65.

The amount of lighting wattage that can be installed in remodeled or renovated space is controlled under the Title 24 energy efficiency standards. Under the standards, the lighting wattage that is allowed for a space is calculated as an upper limit to the amount of wattage that can be installed. That is, planned lighting wattage must be less than the allowed lighting wattage. (In practice, allowed lighting wattage can be calculated using one of four different methods: complete building method, area category method, tailored method, or performance method.[3])

For 66 of the sites in the NRRR sample, data were available from the Title 24 documentation regarding allowed lighting wattage and planned lighting wattage for the spaces being remodeling or renovated. These data are plotted in Figure 8-1. A simple regression of planned lighting wattage on allowed lighting wattage gave the following relationship:

Planned lighting wattage = 0.8806 x Allowed lighting wattage
(R-squared = 0.979.)

This fitted regression (shown by the line in Figure 8-1) implies that planned lighting wattage for the remodeled or renovated spaces was about 12 percent less than allowed by Title 24 standards (i.e., lighting was 12 percent more efficient).

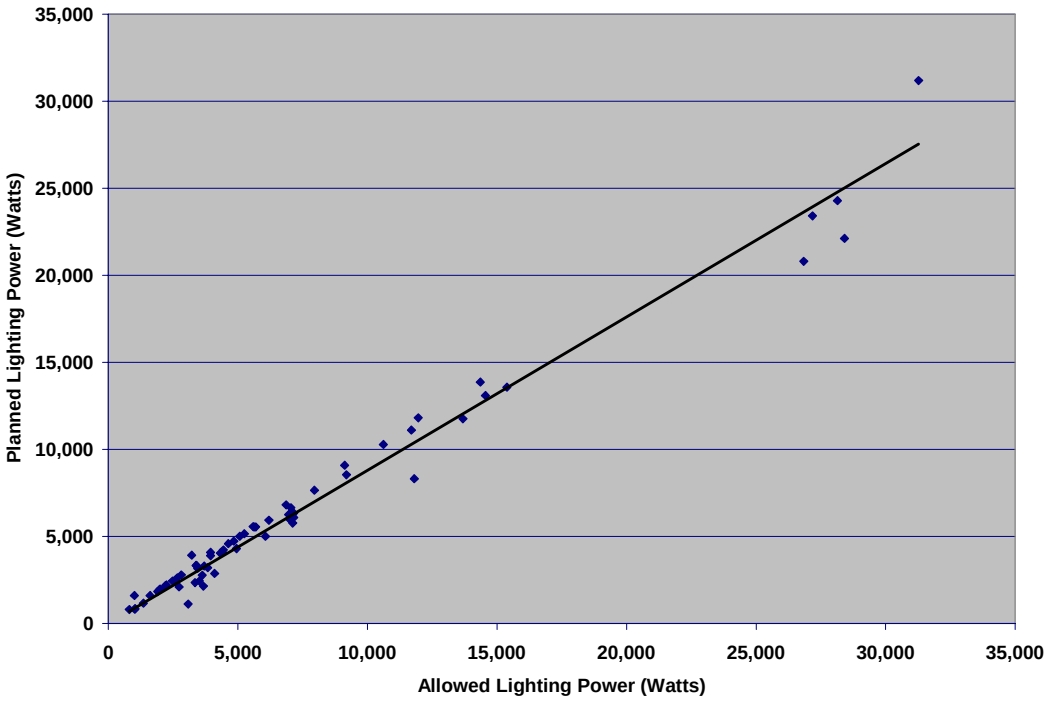

Figure 8-1. Relationship of Planned Lighting Wattage to Allowed Lighting Wattage for Remodeled/Renovated Spaces (n = 66)

[3] See California Energy Commission, *Nonresidential Manual,* November 1998, Chapter 5.

8.4 CHANGES TO HVAC SYSTEMS

Information from both the telephone interviews and from the Title 24 documentation is used in this section to describe changes made to HVAC systems in remodeled or renovated buildings.

8.4.1 Changes to HVAC Systems Reported by Interviewees

In questioning interviewees about the changes that were made to HVAC systems, the distribution portion of the HVAC systems (ducting and piping systems) was distinguished from the major components of HVAC systems (compressors, chillers, and cooling towers). In 83 percent of the buildings, changes were made to the distribution system, major components, or the distribution system and major components. In approximately 38 percent of these situations, the distribution system or refrigerant lines were changed without making changes to major components. Changes only to major components were made by 4 percent, and 58 percent made changes to the distribution system and major components. In other words, changes are somewhat frequently made to distribution lines without changing other parts of the system, but major components are seldom changed without making changes to the distribution system.

For the 58 percent of buildings where the distribution system was changed, about a third were completely replaced. The remaining changes to distribution systems involved extensions, changes in location, changes to components of the distribution system or changes to the remainder of the distribution system.

8.4.2 Characteristics of HVAC Equipment for Remodeled or Renovated Sites as Reported in Title 24 Documentation

Characteristics of HVAC equipment for the sample of remodeled or renovated sites were identified from the Title 24 documentation.

Out of the 311 sites in the documentation sample, the numbers making changes in heating or cooling equipment are shown in Table 8-6. As can be seen, most of the sites making HVAC changes made changes that involved packaged single-zone equipment or heat pumps.

Table 8-6. Number of Sites Making Changes to HVAC Equipment during Remodeling or Renovating

Type of Change	*Number of Sites Making Change*	*Items of Equipment*
Installed new built-up cooling equipment	2	2
Installed new built-up heating equipment	1	1
Installed new packaged single-zone equipment	47	117
Installed new heat pump	43	117
Installed other packaged equipment	4	16

For packaged single zone equipment and heat pumps, information on the capacities and efficiencies were obtained either from the Title 24 documentation or by using manufacturer and model number information to reference the ARI directory of unitary equipment or manufacturers' literature. This information was used to compare the characteristics of the HVAC equipment installed during remodeling or renovating to the characteristics of the equipment installed during new construction. Information on the characteristics of HVAC equipment installed during new construction was taken from the Nonresidential New Construction database for buildings built in 1998. (Although the database also includes data for buildings built in 1994 and 1996, only data for buildings built in 1998 are used for this comparison.)

Information from the two samples with which to compare the relative capacities of packaged single zone equipment and heat pumps in the two kinds of construction is reported in Table 8-7.

- For remodeling/renovating, the sample data show that the installed capacity of packaged single zone equipment was about twice the installed capacity of heat pumps. Although the numbers of items of equipment installed were the same for the two types of equipment, the average tonnage for a piece of packaged single zone equipment was about twice that of the heat pumps.
- For new construction, the sample data show that the installed capacity of packaged single zone equipment was considerably greater than the installed capacity of heat pumps. Nearly ten times more pieces of packaged single zone equipment than of heat pumps were installed, and the average tonnage of the packaged single zone units was just over twice that for heat pumps.
- The average tonnage of both packaged single zone units and heat pumps in new construction was about twice that of the units installed during remodeling and renovating.

Table 8-7. Relative Capacities of Packaged Single Zone HVAC Units and Heat Pumps Installed in Remodeling and Renovating and in New Construction

Type of Equipment	Remodeling/Renovating			New Construction		
	Items of Equipment	Average Tons of Cooling Capacity	Installed Cooling Capacity (Tons)	Items of Equipment	Average Tons of Cooling Capacity	Installed Cooling Capacity (Tons)
Packaged Single Zone HVAC units	117	6.9	806	1,135	14.70	16,679
Heat pumps	117	3.8	441	147	7.0	1,025

Information with which to compare the efficiencies of the packaged units and heat pumps installed during the two kinds of construction are reported in Table 8-8. The efficiencies reported are the average EERs for the equipment when operating in the cooling mode. The average EERs have been calculated using two types of weighting: by number of units and by tons of cooling capacity.

- For remodeling and renovating, the relative efficiencies of packaged units and heat pumps that are installed are fairly similar.
- For new construction, the relative efficiencies of packaged units installed appear relatively higher than for heat pumps when the weighting is by number of units. However, the average efficiencies for the two types of equipment are fairly similar when the weighting for the averaging is by tons of capacity.
- When the average efficiencies of units installed during remodeling and renovating are compared to the average efficiencies of units installed during new construction, the averages are fairly similar when the weighting is by tons of capacity.

Table 8-8. Relative Efficiencies (Cooling Mode) of Packaged Single Zone HVAC Equipment and Heat Pumps Installed in Remodeling and Renovating and in New Construction

Type of Equipment	Remodeling/Renovating		New Construction	
	Average EER Weighted by Number of Units	Average EER Weighted by Tons of Capacity	Average EER Weighted by Number of Units	Average EER Weighted by Tons of Capacity
Packaged Single Zone HVAC units	9.86	9.72	10.26	9.67
Heat pumps	9.85	9.78	9.53	9.66

8.5 SUMMARY AND CONCLUSIONS

This chapter provided information on the characteristics of energy-related technologies (e.g., lighting, HVAC) that are installed during remodeling and renovating to decrease electricity use.

The lighting system is the system most commonly changed during remodeling or renovating, followed by the HVAC distribution system, interior partitions, and HVAC components. Changes to exterior elements occurred 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).

The lighting installed as a result of remodeling or renovation was primarily fluorescent (71.6 percent of installed wattage), incandescent (19.0 percent of installed wattage), and compact fluorescent (4.3 percent of installed wattage). Most of the fluorescent lighting was T8 fluorescent, which alone accounted for 59.1 percent of the installed wattage for the sample of sites with lighting changes.

Based on data on allowed and planned lighting wattages, planned lighting wattage for the 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 are installed during remodeling or renovating are fairly similar. When the average efficiencies of units installed during remodeling and renovating are compared to the average efficiencies of units installed during new construction, the averages are fairly similar when the weighting is by tons of capacity.

9. SUMMARY AND CONCLUSIONS FROM QUANTITATIVE ANALYSIS

The overall purpose of this report has been to use quantitative data to delineate and analyze the market for remodeling and renovating nonresidential buildings in California. The analyses and discussions have been organized around addressing research questions that pertain to both the macro and the micro environments in which remodeling or renovating of nonresidential buildings occurs.

- One set of research questions pertains to the macro environment regarding the remodeling or renovating of nonresidential buildings in California. Aggregate data on remodeling and renovating activity for different geographic areas and different building types were used to address macro-level research questions regarding how much remodeling and renovating activity occurs for nonresidential buildings in California, how this activity has trended over time, how this activity has related to new construction activity, and how big different segments of the market are.
- A second set of research questions pertains to the micro environment for remodeling and renovating activity. Survey data and data from Title 24 documentation have been used to address micro-level research questions regarding the factors that drive remodeling or renovating decisions for particular nonresidential buildings.

9.1 SUMMARY OF MACRO-LEVEL CONCLUSIONS

Extant aggregate data, data being collected in concurrent studies, and qualitative information on remodeling and renovating activity for nonresidential buildings were reviewed to delineate trends in the nonresidential remodeling and renovating market in California. Correlation analysis applied to different data series showed that while the correlation between two new construction data series (commercial and industrial) was moderately high, the correlations of a nonresidential alterations and additions data series with the new construction data series were relatively low. 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.

The results of analyzing the effects of remodeling and renovating activity on electricity use using two different sets of data were generally consistent in showing 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 was shown to increase electricity use.

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 geographical differences across regions in the factors affecting new construction of commercial buildings.

Although extensive modeling to identify the factors affecting the two types of construction activity was beyond the scope for this study, some preliminary analysis was undertaken. Regression analyses were used in which the values of permits issued for nonresidential alterations and additions and for new commercial construction in the different regions were regressed against rate of return measures for commercial properties. The hypothesis being tested was whether higher rates of return for commercial properties induce greater investment both in constructing new properties and in remodeling or renovating existing properties. The results of the regression analyses were different for the two types of construction activity. Rate of return data appear to have statistical significance in explaining movements in permitting activity for nonresidential alterations and additions but not in explaining movements in permitting activity for commercial new construction.

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).

9.2 SUMMARY OF MICRO-LEVEL CONCLUSIONS

Analysis of micro-level decision making regarding remodeling and renovating of nonresidential buildings was accomplished using data collected through a survey of decision makers who had recently made changes to their buildings and from Title 24 documentation for such buildings. The conclusions from this analysis are summarized in the following key findings.

- Most renovation and remodeling is driven by tenancy changes.
- Most tenants are likely to stay in the space for six or more years.
- Offices are more commonly remodeled than retail spaces and other types of spaces are remodeled even less often.
- Architects are involved in most remodels. The owners' in-house architects or the lessees' architects are involved in about half of the projects. Outside architects that are hired are involved in the other half of the projects.
- Lighting and HVAC decisions are heavily influenced by external building professionals or contractors and seldom by utilities, distributors, or manufacturers.
- In HVAC decision-making, internal maintenance staff sometimes plays an important role.
- Title 24, lighting quality , thermal comfort, energy efficiency and reliability are the most important criteria factored into decision-making.
- Professionals can be segmented by the criteria that are important in their decision-making. Most segments focus on multiple criteria. For lighting decisions, the important criteria are Title 24 requirements, improved lighting quality, energy efficiency and equipment reliability. For HVAC decisions, the important criteria Title 24 requirements, improved tenant comfort, energy efficiency, and equipment reliability.
- Owners set the budget which serves as a formal constraint on what can be done. Making the trade-offs within a budget is usually referred to as "value engineering." Value engineering occurs in about 25 percent of projects and can lead to a reduction in energy efficiency.

The results of the decision making are as follows.

- The lighting system is the system most commonly changed during remodeling or renovating, followed by the HVAC distribution system, interior partitions,

and HVAC components. Changes to exterior elements occurred 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).

- The lighting installed as a result of remodeling or renovation was primarily fluorescent (71.6 percent of installed wattage), incandescent (19.0 percent of installed wattage), and compact fluorescent (4.3 percent of installed wattage). Most of the fluorescent lighting was T8 fluorescent, which alone accounted for 59.1 percent of the installed wattage for the sample of sites with lighting changes.
- Based on data on allowed and planned lighting wattages, planned lighting wattage for the 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 are installed during remodeling or renovating are fairly similar. When the average efficiencies of units installed during remodeling and renovating are compared to the average efficiencies of units installed during new construction, the averages are fairly similar when the weighting is by tons of capacity.

9.3 IMPLICATIONS FOR FURTHER STUDY

This quantitative report on the nonresidential remodeling and renovating market taken together with the qualitative report provide the basis for developing program designs for encouraging energy efficiency when nonresidential buildings are remodeled or renovated. The evidence developed so far indicates that decisions at the macro level to remodel or renovate buildings are probably driven by factors that are different than those driving new construction decisions, but that micro level decisions regarding equipment choices are probably similar between remodeling/renovating and new construction.

These themes are taken up in greater detail in a third report that examines program design issues in greater detail. The topics addressed in this third report include the following:

- The level and type of activity occurring in the market for remodeling and renovating of nonresidential buildings;
- Decision-making processes for the purchase of energy-using equipment when nonresidential buildings are remodeled or renovated;

- Segments of the market for remodeling and renovating of nonresidential buildings that have highest potential for making improvements in energy efficiency;
- Potential for improving energy efficiency in the target market segments; and
- Recommendations for new program designs and strategies and additional research with respect to improving energy efficiency when nonresidential buildings are remodeled or renovated.

APPENDIX A: METHODOLOGY

This appendix describes the methodology used to collect data for the analysis discussed in this report.

A.1 SAMPLING PLAN

This section sets out the sampling plan for the quantitative survey research for the NRRR study. The discussion begins with an examination of how the sampling frame for nonresidential remodeling and renovating activity was prepared and then moves to the statistical theory for the sampling approach and the implementation of the approach.

A.1.1 Developing Sampling Frame

The target population for a survey is the specific population about which information is desired. For the quantitative survey effort for the NRRR Study the target population was nonresidential buildings that had undergone remodeling or renovation activities during the year 2000.

To select a sample of buildings that had remodeling or renovating activities, it was necessary to develop a sampling frame that characterized this target population. In general terms, a sampling frame is a list of the ultimate sampling entities, which in this case are nonresidential buildings that had undergone one of the remodeling or renovating activities during 2000.

The ideal for a sampling frame is that each unit in the target population occur once and only once on the frame, each unit is shown separately, any auxiliary information provided for the units is accurate, and units not in the target population are not shown. Under ideal conditions there would be a one-to-one correspondence between the sampling units on the sampling frame and the units in the target population. The units would be mutually exclusive, and the frame would be an exhaustive list of the units.

Conceptually, a sampling frame for the NRRR study could be developed by preparing a list of the nonresidential buildings for which permits for alterations or additions had been issued in 2000. In practice, however, compiling this list for all permit-issuing offices would have been time-consuming and probably cost-prohibitive. There are over 500 permit-issuing offices in California, and there is no central repository for the individual permits that are issued by these offices. Some permit-issuing offices do post lists of permits issued on their websites (e.g., Monterey County, City of Bakersfield), but most do not.

The difficulties in developing a sampling frame that contains all of the nonresidential buildings that might have undergone remodeling or renovating during 2000 was overcome by using a two-stage sampling procedure to select a sample of nonresidential facilities that had been renovated or remodeled in 2000. For this two-stage sampling, permit-issuing locales (i.e., counties and cities) were designated as primary sampling units (PSUs), and permits issued for nonresidential additions or alterations as secondary sampling units. A sample of counties/cities was chosen first and then a sample of permits was chosen from each selected permit-issuing office. A sample selected from among county and city permit-issuing offices with some degree of homogeneity carries less information than a random sample of the same size but which is heterogeneous.[1] On the other hand, using a two-stage sampling approach allowed a reduction in the number of permit-issuing offices that needed to be contacted or visited, thereby reducing costs. The theory for this sampling approach is described in the next section.

A.1.2 Theory for Two-Stage Sampling

For the two-stage sampling, the variance of the value of permits issued for nonresidential alterations or additions is given by the following formula:

$$\text{var}(\bar{y}) = S^2\left\{\left(\frac{N-n}{N}\right)\frac{1+\delta(M_o-1)}{nM_o}+\left(\frac{M_o-m_o}{M_o}\right)\frac{1-\delta}{nm_o}\right\}$$

where $\bar{y}$ is the mean value per permit, S^2 is the variance of permit value in the population, N is the number of permits in the population, n is the number of permit-issuing offices chosen for the sample, M_o is the average number of permits issued per office, m_o is the average number of permits for offices chosen for the sample, and δ is the intraclass correlation coefficient for permit values within a

[1] Formally, this can be seen by comparing the variance of the estimated mean between a random sample and a cluster sample.

For a random sample, $\text{var}(\bar{y}) = \frac{S^2}{n_r}$

For a cluster sample: $\text{var}(\bar{y}) = \frac{S^2}{n_c m_o}\left[1+\delta(m_o-1)\right]$

where S^2 is the variance of the variable in the population, n_r is the size of the random sample, n_c is the number of offices in the cluster sample, m_o is the number of permits sampled from an office from an office, and δ is the intraclass correlation coefficient measuring the degree of homogeneity in the clusters. (δ shows the degree to which permit values within an office are correlated.) Taking $n_r = n_c m_o$, then it can be seen that the variance of the cluster sample is larger to the extent that $\delta > 0$ and $m_o > 1$.

permit-issuing office. (δ shows the degree to which permit values within an office are correlated; if $\delta = 1$, then all permits for an office have the same value.)*

If finite population correction factors are ignored and assuming M_o is large, then the variance equation simplifies to:

$$\text{var}(\bar{y}) = \frac{S^2}{nm_o}\left[1 + \delta\,(m_o - 1)\right]$$

Analytically, the number of the permit-issuing offices to select and the average number of permits to then select from these offices could be determined by solving the following:

$$\text{Minimize var}(\bar{y}) = \frac{S^2}{nm_o}\left[1 + \delta\,(m_o - 1)\right]$$

$$\text{subject to } C = c_1 n + c_2 n m_o + c_{3o}\alpha n m_o$$

where C is the budget available, c_1 is the cost of collecting data on the permits issued by an office, c_2 is the cost of collecting data through a telephone interview for a permit selected from an office, c_3 is the cost of collecting data on-site for a permitted building, α is the percentage of permits for which both telephone interviews and on-site data collection are conducted, and the variance terms are as defined above. The solution to this problem gives the optimum m (average number of permits to be sampled for chosen offices) to be:

$$m_{opt} = \sqrt{\left(\frac{c_1}{c_2 + \alpha c_3}\right)\left(\frac{1-\delta}{\delta}\right)}$$

A.1.3 Calculating Sample Sizes

The formulas set out in Section A.1.2 were used to determine the number of permit-issuing offices to sample. Once a value for m_{opt} is determined, the number of offices to sample is given by inserting m_{opt} into the cost equation and solving for n. Thus, with a fixed budget there is a trade off between m_{opt} and n. That is, the more permits sampled per office, the fewer the number of offices that needed to be sampled.

The equation for determining the number of permits to sample for each selected office shows that the average number of permits to select from chosen offices (m_{opt}) depends on (1) the ratio of costs and (2) the intraclass correlation coefficient for the values for permits for nonresidential alterations or additions within offices. Table A-1 shows the value of m_{opt} for different values of the cost ratio and δ.

Table A-1. Values of m_{opt} for Different Values of Cost Ratio and Intraclass Correlation Coefficient.

Cost Ratio	*Value of δ*				
	0.05	*0.10*	*0.25*	*0.50*	*0.75*
2.5	6.89	4.74	2.74	1.58	0.91
5	9.75	6.71	3.87	2.24	1.29
10	13.78	9.49	5.48	3.16	1.83
25	21.79	15.00	8.66	5.00	2.89

Strong evidence as to the values for the cost ratio and δ were not available. However, our best judgment was that the cost ratio would be between 5 and 10 and that δ is relatively low (i.e., 0.05). The recommended m_{opt} therefore was between 9.75 and 13.78. For working purposes, an $m_{opt} = 10$ was chosen.

Given the budget available for the data collection and with $m_{opt} = 10$, the number of offices to sample was 50.

In practice, because m_{opt} represents the average number of permits to be selected from offices chosen for the sample, the actual number of permits selected from the offices could vary to reflect the different volumes of permitting activity among chosen offices. Accordingly, it was proposed that a minimum of 5 permits be selected from each office, thus allocating 250 sample points. The remaining 250 sample points were then allocated among chosen offices in proportion to the volume of permitting activity for nonresidential alterations and additions.

A.1.4 Selecting Sample of Permit-Issuing Offices

Based on this analysis, the proposed sampling plan was to select a sample of 50 permit-issuing offices as the first-stage sample, to obtain lists of the permits issued by those offices in 2000, and then to sample at least 5 permits for nonresidential remodeling or renovating activity for each of the selected offices, with another 250 permits allocated among offices in proportion to the volume of permitting activity.

Selection of the 50 permit-issuing offices for the first-stage sample needed to take account of the skewness in the distribution of permits issued across the population of permit-issuing offices (as shown by the data in Appendix C). Because of the skewness in the distribution across offices, a stratified sampling approach was used. The Dalenius-Hodges procedure was applied to define five strata, based on value of permits issued. The strata thus determined are defined in Table 4. For sampling purposes, the sample of offices is drawn only from strata 1, 2, 3, and 4.

Table A-2. Definition of Sampling Strata

Stratum	***Permit Value Range***	***Number of Permit-Issuing Offices***	***Total Value (000$) of NRRR A&A Permits Issued***	***Stratum Permit Value as Percent of Total Permit Value***
0	0	45	0	
1	1,000-5,000,000	300	419,965	6.7%
2	5,000,001-15,000,000	96	871,892	13.9%
3	15,000,001-41,500,000	57	1,365,601	21.8%
4	> 41,500,000	30	3,611,743	57.6%
Totals		528	6,269,201	

Given the stratification defined in Table A-2, various schemes for allocating the 50 offices to be sampled across strata were examined. The schemes were evaluated in terms of the precision they provided at the 90 percent confidence level. Because of the predominance of the 30 largest permit-issuing offices, these 30 offices were selected for the sample with certainty. The results of the comparison are shown in Table A-3.

Table A-3. Comparison of Allocation Schemes (Precision Evaluated at 90% Confidence Level)

Stratum	***Allocation Scheme***		
	I	***II***	***III***
1	5	3	10
2	5	7	5
3	10	10	5
4	30	30	30
Precision	6.53%	7.41%	6.59%

This comparison shows Allocation Scheme I provided the best precision, although all of the schemes provided precision better than 10 percent at the 90 percent confidence level. Scheme I was therefore recommended. Using Allocation Scheme I, a preliminary sample of the 50 permit-issuing offices was selected. These offices, which were selected randomly, are shown in Table A-4. Although some of the chosen offices were in the service territories of municipal utilities, they represented areas of significant remodeling and renovating activity for nonresidential buildings that could be informative of possible trends in such activity for other areas.

Table A-4. Permit-Issuing Offices Chosen for Sample

Stratum 1	***Stratum 2***	***Stratum 3***	***Stratum 4***
Marina	Downey	Roseville	Vista
Rolling Hills Estates	Cypress	Carson	Santa Ana
Brisbane	Palm Desert	Newport Beach	Carlsbad
Tulare	Burlingame	San Leandro	Pasadena
Adelanto	Monterey	Vacaville	Hayward
		Poway	Ontario
		Torrance	Beverly Hills
		Folsom	Commerce
		Orange County, Unincorporated	Fresno
		Sonoma County, Unincorporated	Redwood City
			Santa Monica
			Sacramento
			El Segundo
			Palo Alto
			Anaheim
			Oakland
			Costa Mesa
			Fremont
			Irvine
			Sunnyvale
			Milpitas
			Mountain View
			Santa Clara
			San Diego
			San Jose
			San Francisco
			Los Angeles
			Santa Clara County, Unincorporated
			Sacramento County, Unincorporated
			Los Angeles County, Unincorporated

A.1.5 Selecting Facilities That Have Received A&A Permits

Each of the 50 permit-issuing offices chosen for the sample was contacted to obtain a listing of all permits issued by the office during 2000. The manner in which an office's listing of permits could be obtained varied, depending on the particular circumstances by which an office made the data available. As noted above, some offices post listings of permits issued on their web sites, although most apparently do not. Accordingly, telephone and in-person contacts had to be made with many of the 50 offices to obtain the lists of nonresidential permits that were issued during 2000.

The form in which the listings of permits were available differed among offices. Some permit-issuing offices (e.g., City of Los Angeles, City of San Jose,) had computerized listings of the permits issued. However, such computerized listings were not available for all offices. Each office was dealt with on a one-to-one basis to determine the most convenient manner for an office to provide the permits listing.

Once the lists of permits issued had been obtained, a sublist was prepared for each office of those permits that were issued for nonresidential alterations or additions. These sublistings were then used to select the initial sample of permits. As noted above, the initial sample design was to select 500 permits for the sample by selecting at least 5 permits from each office and then allocating the remaining 250 sample points in proportion to the volume of permitting activity for nonresidential alterations and additions. Based on this allocation rule, the initial number of permits to be selected from each office is shown in Table A-5.

In application, this sampling design was modified to accommodate data collection constraints.

- In conducting the first stage telephone survey, names and telephone numbers of the decision makers for remodeling or renovating of a building were needed. However, data that could be obtained from permit-issuing offices for all permits issued during 2000 often did not include such information. Considerable time and effort were being expended on reaching appropriate decision makers to interview.
- Because of this, the sampling approach was modified. The total sample size was reduced to 300. For this sample, complete building permit data (including Title 24 documentation) was collected through visits to the appropriate permit issuing offices. Telephone interviews were then conducted with the decision makers for remodeling or renovating these buildings. The decision makers could be identified from information on the building permits.

The total number of decision makers interviewed was 341, of which 169 were identified through the first method and 172 through the second method.

Table A-5. Initial Allocation for Numbers of Permits to be Sampled per Permit-Issuing Office

Stratum	*County*	*Place*	*Sample*
1	Monterey	Marina	5
1	Los Angeles	Rolling Hills Estates	5
1	San Mateo	Brisbane	5
1	Tulare	Tulare	5
1	San Bernardino	Adelanto	5
2	Los Angeles	Downey	6
2	Orange	Cypress	5
2	Riverside	Palm Desert	5
2	San Mateo	Burlingame	6
2	Monterey	Monterey	6
3	Placer	Roseville	7
3	Los Angeles	Carson	7
3	Orange	Newport Beach	7
3	Alameda	San Leandro	7
3	Orange	Unincorporated	6
3	Sonoma	Unincorporated	6
3	Solano	Vacaville	6
3	San Diego	Poway	6
3	Los Angeles	Torrance	8
3	Sacramento	Folsom	6
4	San Diego	Vista	8
4	Orange	Santa Ana	8
4	San Diego	Carlsbad	8
4	Santa Clara	Unincorporated	8
4	Los Angeles	Pasadena	8
4	Alameda	Hayward	8
4	San Bernardino	Ontario	8
4	Los Angeles	Beverly Hills	8
4	Los Angeles	Commerce	8
4	Fresno	Fresno	9
4	San Mateo	Redwood City	9
4	Los Angeles	Santa Monica	9
4	Sacramento	Sacramento	9
4	Los Angeles	El Segundo	9
4	Santa Clara	Palo Alto	9
4	Orange	Anaheim	10
4	Alameda	Oakland	10
4	Sacramento	Unincorporated	11
4	Orange	Costa Mesa	11
4	Los Angeles	Unincorporated	11
4	Alameda	Fremont	11
4	Orange	Irvine	11
4	Santa Clara	Sunnyvale	12
4	Santa Clara	Milpitas	13
4	Santa Clara	Mountain View	15
4	Santa Clara	Santa Clara	15
4	San Diego	San Diego	22
4	Santa Clara	San Jose	23
4	San Francisco	San Francisco	37
4	Los Angeles	Los Angeles	

A.2 DATA COLLECTION METHODOLOGY

Data regarding the buildings to which the permits pertained were collected in two phases.

As the first phase of the data collection, a telephone survey of market actors (e.g., owners, tenants, architects) was begun for the facilities selected for the sample. The telephone interview was used to determine what has been done in the remodeling and renovating of a building with respect to structural and equipment changes that impact energy use and why the changes were made.

A draft of the questionnaire that was the instrument for the telephone survey is provided in Appendix B. This questionnaire was structured so that interviewees were asked questions that pertain to changes that resulted from the remodeling or renovating of the particular building that was identified through the permit data as having been remodeled or renovated in 2000. These questions were directed at determining what changes were made, whether these changes improved energy efficiency, and what factors were important in deciding whether or not to improve the energy efficiency of the lighting.

As the second phase of the data collection, Title 24 documentation was collected from the building permits offices for the localities in which the facilities were located. That is, Title 24 documentation is included with permits, which are themselves public records in California, open to inspection. Collecting the Title 24 documentation allowed detailed information to be extracted regarding the measures installed during the remodeling or renovation to improve the energy efficiency of the facilities. This information allowed the developing of more detailed information on the characteristics of the facilities. The accuracy of the self-reported information obtained through the telephone survey could also be checked. The information collected from the Title 24 documentation is identified in Table A-6.

There are some cases of remodeling and renovation 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.

However, 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.

Table A-6. Building Characteristics Information to be Collected from Title 24 Documentation

- General Information
  - Building Name
  - Project Address
  - Building Type
  - Total Floor Area
  - Conditioned Floor Area
- Shell Characteristics
  - Wall Type
  - Insulation R-value
  - Overall U-value
  - Roof Type
  - Insulation R-value
  - Overall U-value
  - Floor Type
  - Insulation R-value
  - Overall U-value
- Windows
  - Maximum Window Area
  - Maximum U-value
  - RSHG, North
  - RSHG, Non-North
- Skylights
  - Type (e.g., transparent, translucent)
  - Maximum U-value
  - RSHG
- Lighting
  - Types and numbers of fixtures, lamps, and ballasts
  - Types of control
- Air Distribution System
  - Type
  - Minimum ventilation rate (CFM/SF)
  - Duct insulation
  - Maximum fan power
  - Economizer
- Cooling Equipment
  - Type
  - Capacity
  - Efficiency (e.g., SEER, EER, COP)
- Heating Equipment
  - Type
  - Capacity
  - Efficiency
- Water Heaters
  - Type
  - Capacity
  - Efficiency (e.g., energy factor)

As the third phase of the data collection, a subsample of facilities was selected from among the facilities for which Title 24 documentation had been collected, and on-site visits were made to these facilities to verify the changes that had been made and to collect information pertaining to lighting and equipment capacities and efficiencies. On-site inspection is useful for facilities that have been remodeled or renovated in that anecdotal evidence from building department personnel suggests that inspection and code enforcement for remodeling and renovation work is less strict than for new construction. For example, there can be considerable remodeling and renovation work that converts space that was originally designed for warehousing into office space. Warehouse or speculative buildings that have only a shell and rough plumbing when originally built do not have to comply with Title 24. Compliance is only required when the tenant

improvements are made to add to the lighting or HVAC system. If enforcement of Title 24 is laxer for such tenant improvements, then the effectiveness of Title 24 in encouraging energy efficiency for remodeling and renovation may be lessened. Collecting data on-site and comparing that data to the Title 24 documentation will allow a better assessment of whether this is indeed a problem.

A.3 DATA PREPARATION, PROCESSING AND QUALITY CONTROL

The data collected for the sampled facilities were entered into an integrated database for tabulation and analysis. This integrated database was prepared using Microsoft *Excel*™ and *Access*™.

After the data had been entered into the database, they were verified. This verification includes automated as well as manual checks. These checks were applied to insure good data quality and to minimize the errors attributable to mis-coding, mis-judgments, or incorrect responses. The data were passed through three stages of error-checking.

- The first stage of the error-checking was used to detect typing errors that might have been introduced through the data entry process. Under this procedure, all coded entries were tested by either a range check or a table-lookup check.
- The second stage of the error-checking was used to detect errors and/or inconsistencies that might exist within the data for a given respondent. Entries for a respondent were cross-checked against each other to ensure that they were correct.
- The third stage of the error-checking was used to detect internal inconsistencies within the database. Respondents were grouped by different classification variables (e.g., location, type of building), and the data for respondents of each type were processed through a set of statistical analysis routines. Respondents that were classified as "outliers" by this analysis were individually examined for validity. Both tabulations and data plots were used during this stage of the error-checking.

APPENDIX B: DATA COLLECTION FORMS

Data collection forms used in the NRRR Study are provided in this appendix. These include:

- Questionnaire for survey of decision makers
- Data collection form for on-site data collection

Start Time: __:__

ID number: _____

CEC Renovation and Remodeling Survey

Respondent Information (pre-filled)

I1. Name of project from the sample: _____
I2. Address of the project: _____
Firms and contacts associated with the project

Firm	Name of Person	Title / Profession	Address	Telephone number

I3. Name of person to be interviewed: _____
I4. Address 1: _____
I5. Address 2: _____
I6. City: __ State: _____ Zip _____
I7. Telephone: (___) ____ - ____Telephone 2:(___) ____ - ____
I8. Fax: (___) ____ - ____

Contact log

Date month, day, year mm dd yy	Time in (24 hour clock) hh m m	Time out (24 hour clock) h h mm	Result: 1. Complete, 2. Callback, 3. No answer, 4. No contact, 5. Wrong number, 6. Refusal, 7. Moved known, 8. Moved unknown, 9. Other (describe) Write in call back date and time
I9a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _ _
I10a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _ _
I11a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _ _
I12a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _ _
I13a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _ _
I14a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _ _

Hello, my name is _____. I'm calling on behalf of the California utilities and the California Energy Commission. I'd like to speak with *(INSERT NAME FROM QI3*).

I15. Disposition
1 Correct person on line-----*>(CONTINUE)*
2 Correct person not available-----> *(IDENTIFY A CALLBACK TIME)*
3 Correct person has new telephone -----> *(TRY TO OBTAIN NEW TELEPHONE NUMBER)*

3 Correct person no longer works for company -----> *(TRY TO IDENTIFY AN ALTERNATIVE CONTACT OR DROP PROJECT FROM SAMPLE)*
4 Correct person asks for callback-----> *(SET CALLBACK OR DROP FROM SAMPLE)*
4 Correct person refuses-----> *(TERMINATE AND DROP FROM SAMPLE)*

Introduction

The California electric utilities and the California Energy Commission are trying to better understand commercial remodeling and renovation practices in order to learn how to encourage greater energy efficiency in commercial buildings. You and/or your firm have been identified as a key player for a remodeling and renovation project called *(INSERT THE NAME OF THE PROJECT FROM QUESTION I1)* located at *(INSERT ADDRESS FROM I2)*. I would like to ask you some questions about that project and about how decisions are made in renovation and remodeling projects, especially as they relate to energy efficiency. Your responses will provide a basis for improving current state-funded programs in this area and for identifying needs for new programs or possible policy changes. It is important that we talk with you. Do you have time to complete the survey now?

I16. ❑ Yes ❑No →Set new time

↓

A. Characteristics of the Renovation and Remodeling Project

Let me start by asking a few questions about the project called *(INSERT THE NAME OF THE PROJECT FROM QUESTION Q1)* located at *(INSERT THE LOCATION OF THE PROJECT FROM QUESTION QI2*

1. Is that building:

	Yes	No	DK	NA	
a.	❑	❑	❑		Owner occupied or intended to be owner occupied
b.	❑		❑	❑	Leased to tenants or intended to be leased to tenants
c.	❑		❑	❑	Jointly occupied by the owner and tenants

2. Was the goal of the most recent remodeling and renovation activities to (*CHECK AS MANY AS APPLY*):

	Yes	No	DK	NA	
a.	❑		❑	❑	Finish previously unfinished space
b.	❑		❑	❑	Alter space to account for changes in tenancy or tenant operations
c.	❑	❑	❑		Change the space from one use to a completely different one, for example from a warehouse to an office space
d.	❑		❑	❑	Upgrade the quality and or functionality of space in order to change the class of the building and/or increase the lease value
e.	❑	❑	❑		Generally update the building to replace aging equipment, extend the life of the building or freshen a building's look without changing the class of a building

f. ❑ ❑ ❑ Was there some other goal? (*IF YES, PLEASE SPECIFY*)_____

3. (*ASK IF 1B = YES OR 1C = YES ELSE GO TO Q4*) For whom was the project completed?

	Yes	No	DKNA	
a.	❑	❑	❑	A developer or a commercial real estate firm that owns and leases space
b.	❑	❑	❑	A commercial real estate firm that manages space for an owner
c.	❑	❑	❑	A commercial real estate firm that does triple net leasing
d.	❑	❑	❑	A tenant with a ground lease
d.	❑	❑	❑	A tenant that is leasing the space
e.	❑	❑	❑	Some other type of firm? (*Please specify and explain if necessary*)_____

4. Is the firm for whom the renovation was done likely to hold the building or space for:

	Yes	No	DKNA	
a.	❑	❑	❑	three years or less
b.	❑	❑	❑	four or five years
c.	❑	❑	❑	six years or more
d.	❑	❑	❑	DKNA

5. Subsequent to the remodeling, what is the primary use or uses of the building (*CHECK AS MANY AS APPLY. DON'T READ BUT PROBE TO GET THE RIGHT CATEOGRY)*? . . . . (*PROBE A SECOND TIME*) Are there any other uses of the building?

	Yes	No	DKNA	
a.	❑	❑	❑	Retail space less than 10,000 square feet
b.	❑	❑	❑	Retail space 10,001 and 25,000 square feet
c.	❑	❑	❑	Retail space greater than 25,000 square feet
d.	❑	❑	❑	Low rise office space or building (three floors or less)
e.	❑	❑	❑	Mid-rise office space or building (4 – 9 floors)
f.	❑	❑	❑	High-rise office space or building (10+ floors)
g.	❑	❑	❑	Warehouse
h.	❑	❑	❑	Restaurant
i.	❑	❑	❑	Public assembly
j.	❑	❑	❑	School
k.	❑	❑	❑	Religious worship
l.	❑	❑	❑	Industrial
m.	❑	❑	❑	Other (please specifiy):

6. (*ASK IF 2C = YES ELSE GO TO 7*) Earlier, you indicated that the use of the building changed from what it was before remodeling. What was its use before renovation or remodeling? (*CHECK AS MANY AS APPLY. DON'T READ BUT PROBE TO GET THE RIGHT CATEOGRY)*? . . . (*PROBE A SECOND TIME*) Any other uses?

Yes No DKNA

a.❑ ❑ ❑ Retail space less than 10,000 square feet
b. ❑ ❑ ❑ Retail space 10,001 and 25,000 square feet
c.❑ ❑ ❑ Retail space greater than 25,000 square feet
d. ❑ ❑ ❑ Low rise office space or building (three floors or less)
e.❑ ❑ ❑ Mid-rise office space or building (4 – 9 floors)
f. ❑ ❑ ❑ High-rise office space or building (10+ floors)
g. ❑ ❑ ❑Warehouse
h. ❑ ❑ ❑Restaurant
i. ❑ ❑ ❑ Public assembly
j. ❑ ❑ ❑ School
k. ❑ ❑ ❑Religious worship
l. ❑ ❑ ❑ Industrial
m. ❑ ❑ ❑Other (please specify):

7. Was an architect used for any of the design work?

❑ Yes ❑ No ❑ DKNA

8. Who was <u>primarily</u> responsible for producing the designs and specifications for the project?

a.❑ The owner or developer's in-house planning and design staff
b. ❑ An architect and/or associated consultants hired by the owner/developer to develop the plans and specifications
c.❑ A general contractor who used their own staff and/or consultants as needed
d. ❑ A contractor and/or subcontractors using their own staff or consultants as needed
e.❑ Other: (Please specify)_____

9. Who was primarily responsible for determining the overall base budget for the renovation (*CHECK AS MANY AS APPLY*)?
a.❑ The owner and/or the owner's staff
b. ❑ A developer and/or the developer's staff
c.❑ A consultant or consulting architect working for the owner/developer
d. ❑ The owner with input from an architect and/or contractors
e.❑ Owner in consultation with investors or bankers
f. ❑ Other: (Please specify)_____

10. Did the project involve substantial changes to (*CHECK ALL THAT APPLY*):

	Yes	No	DKNA	
a.	❑	❑	❑	Shell of the building
b.	❑	❑	❑	Interior of the building or internal building systems

11. Did the project include an addition to the building

❑ Yes ❑ No ❑ DKNA

12. Roughly what is the total square footage of the building before any renovations?
_____ sq. ft.

13. Roughly how many square feet were remodeled or renovated excluding additions? _____ sq. ft.

14. (*IF Q11 = YES ELSE GO TO 15*) Roughly how many square feet were added to the building? _____ sq. ft.

15. Can you tell me roughly the total value of the remodeling and renovation?

_____ Dollars (*BE SURE TO RECORD TO THE RIGHT NUMBER OF DIGITS TO LEFT OF THE DECIMAL PLACE*)

16. During remodeling and renovation were substantial changes made to: (*CHECK ALL THAT APPLY*)?

	Yes	No	DKNA	
a.	❑	❑	❑	layout of interior partitions
b.	❑	❑	❑	lighting
c.	❑	❑	❑	HVAC system components (chillers, pumps, rooftop units, cooling tower, etc.)
d.	❑	❑	❑	HVAC distribution system (piping, ducts, etc.)
e.	❑	❑	❑	power distribution system and infrastructure
f.	❑	❑	❑	external windows, skylights, and/or doors
g.	❑	❑	❑	shell structure, ornamentation, and façade elements
h.	❑	❑	❑	roof system

17. (*IF 16A =YES ELSE GO TO 20*) Can you tell me roughly what percentage of the floor space was affected by changes in the layout of interior partitions?
_____ percent ❑ DKNA

18. After changing the layout were light switches and thermostatic controls repositioned to insure that users have access to the controls?
❑ Yes ❑ No ❑ DKNA

19. After changing the layout was the HVAC distribution system redesigned and reconfigured to take into account changes in the floor plan so that users control the HVAC in their area?
❑ Yes ❑ No ❑ DKNA

20. (*IF 16B = YES THEN GO TO 26*) Were the existing lighting fixtures primarily

❑ re-used ❑ replaced ❑DKNA

21. Was the energy efficiency of the lighting improved by changes made during the remodeling?

❑ Yes➔ *Go to Question 22*
❑ No➔ *Go to Question 24*.

22. What sources of information about lighting improvements did you use in remodeling or renovating of this building? *(CHECK ALL THAT ARE MENTIONED)*
a. ❑Internal maintenance staff
b. ❑Internal design staff
c. ❑Electrical engineer
d. ❑Lighting designer
e. ❑Consulting engineer
f. ❑Contractors
g. ❑Dealers
h. ❑Distributors
i. ❑Manufacturers
j. ❑Utilities
k. ❑Trade publications
l. ❑Other: _____

23. Now, I would like to have you think about factors that influenced your decisions about lighting during the remodeling/renovation work. On a scale of "1" to "10" where "1" is "not at all important" and 10 is "very important.", how important were the following factors:

	Factor:	*Not at all Important* 1 2 3 4 5 6 7 8 9 10 *Very Important* 11 *DKNA*
a.	An acceptable payback from energy savings	1 2 3 4 5 6 7 8 9 10 11
b.	High equipment reliability	1 2 3 4 5 6 7 8 9 10 11
c.	Title 24 requirements	1 2 3 4 5 6 7 8 9 10 11
d.	Improved quality of lighting	1 2 3 4 5 6 7 8 9 10 11
e.	Price or first cost of the item	1 2 3 4 5 6 7 8 9 10 11
f.	Ability to recapture the cost of an item in the lease rate	1 2 3 4 5 6 7 8 9 10 11
g.	*Energy efficiency of the item*	1 2 3 4 5 6 7 8 9 10 11
h.	Prior experience with the equipment	1 2 3 4 5 6 7 8 9 10 11
i.	Were there any other factors? If so what?	1 2 3 4 5 6 7 8 9 10 11

	Factor:	*Not at all Important* *Very Important* *DKNA*
	(Enter the factor and then ask) And how important was this factor?	
j.	Were there any other factors? If so what? *(Enter the factor and then ask)* And how important was this factor?	1 23 4 5 6 7 8 9 10 11

Go to item 26

24. I am going to read a list of reasons why your company may not have made energy efficiency improvements to lighting during the remodeling/renovation work. On a scale of "1" to "10" where "1" is not at all important and "10" is very important, how important was the (*INSERT REASON FROM THE TABLE BELOW*) in preventing you from making the improvement. (*AFTER THE FIRST ITEM SAY*) And how about (*INSERT ITEM FROM TABLE BELOW*)

	Reason:	*Not at all Important* *Very Important* *DKNA*
a	The fact that the lighting was already efficient	*1 2 3 4 5 6 7 8 9 10 11*
b.	Initial cost of energy efficient improvement	*1 2 3 4 5 6 7 8 9 10 11*
c.	Lack of knowledge of energy efficient lighting options	1 23 4 5 6 7 8 9 10 11
d.	Low or non-existent payback from lighting improvements	1 23 4 5 6 7 8 9 10 11
e.	Lack of experience with energy efficient lighting	1 23 4 5 6 7 8 9 10 11
f	In ability to recover the cost in lease rates	1 23 4 5 6 7 8 9 10 11
g.	Concerns about reliability of efficient lighting	1 23 4 5 6 7 8 9 10 11
i.	Were there any other reasons? If so what? *(Enter the reason and then ask)* And how important was this reason?	1 23 4 5 6 7 8 9 10 11
j.	Were there any other reasons? If so what? *(Enter the reason and then ask)* And how important was this reason?	1 23 4 5 6 7 8 9 10 11

25. If you had been offered a (*INSERT ITEM FROM TABLE BELOW*) when deciding on the lighting system for the building, would you have been very likely, somewhat likely or not very likely to choose more efficient lighting?
(*FOR ITEMS AFTER THE FIRST ITEM*) And what about (*INSERT ITEM FROM TABLE BELOW*), would that be very likely, somewhat likely or not very likely?

		Very Likely	*Somewhat Likely*	*Not Very Likely*	*Don't Know*
a.	Low interest loan to make improvements	❑	❑	❑	❑
b.	Rebate on the equipment purchase price	❑	❑	❑	❑
c.	Informational seminars on lighting	❑	❑	❑	❑
d.	Free technical design assistance for lighting	❑	❑	❑	❑
e.	An opportunity to obtain efficient lighting equipment through a multi-year contract with a third party that allowed you to payback the cost through savings (i.e., a performance or shared savings contract)				
f.	How about some other incentive? If so what? *(Enter the incentive and then ask)* And how likely is it that you would have used this incentive if it were offered?	❑	❑	❑	❑
g.	How about some other incentive? If so what? *(Enter the incentive and then ask)* And how likely is it that you would have used this incentive if it were offered?	❑	❑	❑	❑

26. (*IF 16C OR 16D = YES ELSE GO TO 34*) Was the air distribution system or refrigerant lines changed or replaced?

❑ Changed ❑ Replaced ❑ Neither ❑ DKNA

27. Were the HVAC components, such as chillers, cooling towers, or roof-top units, replaced with components that were more efficient than the ones that were previously installed?

❑ Yes ❑ No ❑ DKNA

28. Were the HVAC components and distribution system optimized to take into account new features and other changes in the building?

❑ Yes ❑ No ❑ DKNA

29. Overall, was the HVAC system more energy efficient after than before renovation?

❑ Yes (*GO TO 30*) ❑ No (*GO TO 32*) ❑DKNA (*GO TO 32*)

30. In thinking about the remodeling or renovation of this building and the HVAC system, who did you rely on for information about equipment and designs? *(CHECK ALL THAT ARE MENTIONED)*

a. ❑ Internal maintenance staff
b. ❑ Engineering firm
c. ❑ HVAC contractor
d. ❑ HVAC consultant
e. ❑ Dealers
f. ❑ Distributors
f. ❑ Manufacturers
h. ❑ Utilities
i. ❑ Trade publications
j. ❑ Other: _____

31. When deciding on improvements for the building's HVAC system during the remodeling/renovation work, how important were the following when rated on a scale of "1" to "10", where "1" is "Not at all important" and "10" is "Very important".

	Factor:	*Not at all Important*								*Very Important*	*DKNA*
a.	*An acceptable payback from energy savings*	1	2	3	4	5	6	7	8	9	10	11
b.	Improved comfort for tenants	1	2	3	4	5	6	7	8	9	10	11
c.	Complied with Title 24	1	2	3	4	5	6	7	8	9	10	11
d.	High equipment reliability	1	2	3	4	5	6	7	8	9	10	11
e.	Price or first cost	1	2	3	4	5	6	7	8	9	10	11
f.	Cost could be recaptured in the lease rate	1	2	3	4	5	6	7	8	9	10	11
g.	*Because it was energy efficient*	1	2	3	4	5	6	7	8	9	10	11
h.	Prior experience with the equipment	1	2	3	4	5	6	7	8	9	10	11

	Factor:	*Not at all Important* *Very Important* *DKNA*
i.	Were there any other factors? If so what? *(Enter the factor and then ask)* And how important was this factor?	1 23 4 5 6 7 8 9 10 11
j.	Were there any other factors? If so what? *(Enter the factor and then ask)* And how important was this factor?	1 23 4 5 6 7 8 9 10 11

GO TO QUESTION 34.

32. I am going to read a list of reasons why you may not have made energy efficiency improvements to the HVAC system during the remodeling/renovating work. Please rate each on a scale from "1" to "10", where "1" is "Not at all important" and "10" is "Very important".

	Reason:	*Not at all Important* *Very Important* *DKNA*
a.	The system was ok as it was	1 23 4 5 6 7 8 9 10 11
b.	Had to cut costs	1 23 4 5 6 7 8 9 10 11
c.	Would have had to meet Title 24 or permitting requirements if the system were changed	1 23 4 5 6 7 8 9 10 11
d.	Changes would not have enhanced the value of the space	1 23 4 5 6 7 8 9 10 11
f.	Initial cost of energy efficiency improvements was too high	*1 2 3 4 5 6 7 8 9 10 11*
g.	Lacked knowledge of energy efficiency options for HVAC system	1 23 4 5 6 7 8 9 10 11
h.	Low or non-existent payback for the company from improvements	1 23 4 5 6 7 8 9 10 11
i.	Lack of experience with energy efficiency improvements for HVAC	1 23 4 5 6 7 8 9 10 11
j.	Concerns about reliability	1 23 4 5 6 7 8 9 10 11
l.	Were there any other reasons? If so what? *(Enter the reason and then ask)* And how important was this reason?	1 23 4 5 6 7 8 9 10 11
m	Were there any other reasons? If so what? *(Enter the reason and then ask)* And how important was this reason?	1 23 4 5 6 7 8 9 10 11

33. If you had been offered a (*INSERT ITEM FROM THE TABLE BELOW*). when deciding whether to modify the HVAC system in the building, would you have been very likely, somewhat likely or not at all likely to choose more efficient HVAC system?
(*FOR ITEMS AFTER THE FIRST ITEM*) And what about about (*INSERT ITEM FROM THE TABLE BELOW*), would that be very likely, somewhat likely or not at all likely?

	Service	*Very Likely*	*Somewhat Likely*	*Not Very Likely*	*Don't Know*
a.	Low interest loan to make improvements	❑	❑	❑	❑
b.	Rebate for the equipment purchase price	❑	❑	❑	❑
c.	Informational seminars on HVAC	❑	❑	❑	❑
d.	Free technical design assistance for the HVAC system	❑	❑	❑	❑
e.	An opportunity to obtain efficient HVAC equipment through a multi-year contract with a third party that allowed you to payback the cost through savings (i.e., a performance or shared savings contract)	❑	❑	❑	❑
e.	How about some other incentive? If so what? *(Enter the incentive and then ask)* And how likely is it that you would have used this incentive if it were offered?	❑	❑	❑	❑
f.	How about some other incentive? If so what? *(Enter the incentive and then ask)* And how likely is it that you would have used this incentive if it were offered?	❑	❑	❑	❑

34. (*IF 16F = YES ELSE GO TO 36*) Were the windows replaced or was film applied to existing windows?

❑ Film (*GO TO 36*) ❑ DKNA (*GO TO 36*) ❑Replaced (*GO TO 35*)
❑ Neither (*GO TO 36*)

35. Are the new windows more energy efficient than the previous windows :
❑ Yes ❑ No ❑DKNA

36. Were skylights and dimming controls installed to supply light in work areas?

❑ Yes ❑ No ❑ DKNA

37. (*IF 16G = YES ELSE GO TO 38*) Were exterior shading elements added?

❑ Yes ❑ No ❑ DKNA

38 (*IF 16G = YES OR 16H = YES ELSE GO TO 39*) Was insulation replaced or installed on external walls and/or under the roof?

❑ Yes ❑ No ❑ DKNA

39. In order to meet a budget, it is sometimes necessary to reduce the complexity of proposed systems or substitute less costly components. This is sometimes referred to as "value engineering." For this project, was it necessary to do value engineering?

❑ No (*GO TO 43*) ❑ DKNA (*GO TO 43*) ❑ Yes (*GO TO 40)*

40. For the project we are discussing, which of the following were subject to value engineering?

	Yes	No	DKNA	
a.	❑	❑	❑	lighting
b.	❑	❑	❑	HVAC system components
c.	❑	❑	❑	HVAC distribution system
d.	❑	❑	❑	Power distribution system and infrastructure
e.	❑	❑	❑	external windows and doors
f.	❑	❑	❑	shell structure, ornamentation, and façade elements
g.	❑	❑	❑	roof system

41. (*IF 40A = YES ELSE GO TO 42*) You said that the lighting system was subject to value engineering. Did value engineering result in:

	Yes	No	DKNA	
a.	❑	❑	❑	reducing the number of controls
b.	❑	❑	❑	using less efficient fixtures
c.	❑	❑	❑	replacing fewer fixtures

42. (*IF 40B = YES AND/OR 40C = YES ELSE GO TO 43*) You said that HVAC system components were subject to value engineering. Did value engineering result in:

	Yes	No	DKNA	
a.	❑	❑	❑	reducing the number of controls
b.	❑	❑	❑	reducing the number of zones
c.	❑	❑	❑	using less efficient components
d.	❑	❑	❑	replacing fewer components
d.	❑	❑	❑	minimizing changes to distribution systems

43. Do you have a rule of thumb about the age at which you replace major pieces of equipment such as boilers and chillers when remodeling and renovating?

❑ No (*GO TO 45*) ❑ DKNA (*GO TO 45*) ❑ Yes (*GO TO 45*)

44. After what age do you usually replace such equipment?
_____ years _____ DKNA

45. Do you have a general rule of thumb for the maximum payback period in years for efficient equipment that you consider for a project like the *(INSERT THE NAME FROM QI1)*?

❑ No (*GO TO 47*) ❑ DKNA (*GO TO 47*) ❑Yes (*GO TO 46)*

46. How many years is that?
_____ years _____ DKNA

47. (*IF Q1 = "B" OR Q1 = "C" ELSE GO TO Q50*) For the project we have been discussing, is the electricity used for lighting and plug loads paid for

❑ by the tenant directly to the utility
❑ by the tenant to the building owner as a separate item
❑ in the tenant's overall lease payment
❑ DKNA

48. What about the energy for cooling, is it paid fro

❑ by the tenant directly to the utility
❑ by the tenant to the building owner as a separate item
❑ in the tenant's overall lease payment
❑ DKNA

49 What about the energy for heating, is it paid for

- ❑ by the tenant directly to the utility
- ❑ by the tenant to the building owner as a separate item
- ❑ in the tenant's overall lease payment
- ❑ DKNA

50. For the project we are discussing, were any rebates for energy efficient equipment received?

❑ Yes ❑ No ❑ DKNA

51. For the project we are discussing, were any of the improvements financed by a third party who then received payment for services through the energy savings? These are called *standard performance contracts* or *shared savings*.

❑ Yes ❑ No ❑ DKNA

52. For the project we are discussing, were any of the improvements completed as a result of receiving incentive payments for good design?

❑ Yes ❑ No ❑ DKNA

F. CHARACTERISTICS OF THE FIRM

53. What is the main business line of your firm? (*RECORD THE ANSWER AND PROBE TO FIT INTO ONE OF THE FOLLOWING CATEGORIES IF NECESSARY)* _____

Real estate
- a. ❑ Real estate development
- b. ❑ Commercial real estate owner
- c. ❑ Commercial real estate management

Building professional
- d. ❑ Architecture
- e. ❑ Electrical engineering
- f. ❑ Mechanical engineering
- g. ❑ Structural engineering
- h. ❑ Energy engineer
- i. ❑ Other engineer _____

Contractor
- j. ❑ General contractor
- k. ❑ Electrical contractor
- l. ❑ Mechanical contractor

m.❑ Other contractor _____

Other
o. ❑ Building owner with non-estate related business
p. ❑ Real estate investor or Banker
q. ❑ Other _____

54. (*Ask if 53A or 53B or 53C or 53O else go to 55*) About how many square feet of commercial property do you own or manage?

_____ square feet of property *in 000's*

55. Can you give me a rough estimate of the gross annual revenues of you firm in millions. If less than a million just indicate a million?

_____ $ of Gross revenue in millions

56. About how many years has your firm been in business?_____ *Years.* (DKNA = 999)

G RESPONDENT CHARACTERISTICS

57. What is your job title?_____
(Interviewer: enter what the person says then code one of the following. If you are not sure use the

following categories to probe. If you are still not sure, leave the answer for later coding.)

- ❑ Owner / Partner
- ❑ President
- ❑ Executive vice-president
- ❑ Senior vice-president
- ❑ Project manager (engineer or architect)
- ❑ Construction manager (primarily responsible for constructing new complexes)
- ❑ Operations manager (responsible for managing day-to-day operations for several sites)
- ❑ Maintenance manager (responsible for oversight of maintenance at multiple sites)
- ❑ Project manager (responsible for construction at one or more sites)
- ❑ Site manager (responsible for leasing and day-to-day operations of a complex)
- ❑ Maintenance supervisor / building / site engineer (supervises maintenance at a complex)
- ❑ Maintenance person
- ❑ Other:

58. Do you have any professional or organizational affiliations where you frequently discuss business issues with professionals like yourself?

❑ No (*GO TO 60*) ❑ DKNA (*GO TO 60*) ❑Yes (*GO TO 59*)

59. What affiliations/memberships are these?

_____

_____

60. That concludes my questions. Do you have any other comments that you would like to make about energy efficiency share with the California Energy Commission relating to energy and / or remodeling and renovation of commercial buildings?

Record any customer questions or concerns:

_____

_____

Ms. Sylvia Bender, the project manager for this study, can be contacted for further questions. She can be reached at California Energy Commission at: 916-653-6841.

Thanks for your help!

End Time: __:____

Auditor	Checked by	Date Received	Data Entry by	Engineer	ID Number

California Energy Commission

Non-Residential Remodeling & Renovation Study

January 2001

Introductory Information

Audit Date: (month/day/year) __ __ /__ __ /__ __

Auditor: __

Business Name: __

Street Address: __

City, State: __ , __ __

Zip Code: __ __ __ __ __ - __ __ __ __

Business Contact #1:__ __

Name: __

Title: __

Phone # ( ): (__ __ __) __ __ __ __ __ __ __ __ ext. __ __ __ __

Business Contact #2:__ __

Name: __

Title: __

Phone # ( ): (__ __ __) __ __ __ __ __ __ __ __ ext. __ __ __ __

Business Contact #3:__ __

Name: __

Title: __

Phone # ( ): (__ __ __) __ __ __ __ __ __ __ __ ext. __ __ __ __

Establishment Site Activity

Office:	Administration and management	011	Restaurant:	Fast Food or Self Service	021
	Financial / Legal	012		Table Service	022
	Insurance/Real Estate	013		Bar/Tavern/Nightclub/Other	023
	Other Office	014			
Food Store:	Supermarket	031	Retail Store:	Department / Variety Store	041
	Convenience Store	032		Shop in Enclosed Mall	042
	Other Food Store	033		Other Retail Store	043
Warehouse:	Refrigerated Warehouse	051	Health Care:	Hospital	061
	Nonrefrigerated Warehouse	052		Nursing Home	062
				Medical Office	063
				Clinic/Outpatient Care	064
Education:	Daycare or Preschool	071	Lodging:	Hotel	081
	Elementary / Secondary School	072		Motel	082
	College or University	073			
	Vocational or Trade School	074			
Public Assembly:	Church	091	Services:	Gas Station / Auto Repair	101
	Recreational or Other	092		Repair (Non-Auto)	102
				Other Service Shop	103
Manufacturing:	Assembly / Light Mfg.	111			
	Med/Heavy Equip. Mfg.	112	Other:	Describe	120
	Food/Beverage Processor	113		Construction	121
	Mining	114		Agriculture	122

Establishment site activity: _____

General Information

Number of buildings in the audit area? __ __ __ __
Year the surveyed building was built? __ __ __ __
Year business established at this location? __ __ __ __

Establishment:

Audit Area:

The audit area can be described as:	1 = Detached, 2 = Attached, 3 = Enclosed, or part of 4 = Plaza or 5 = Mall	__

Audit Area Building Specification: **Note: "Area Percentages" must add up to 100%.**

- Total audit area _____SqFt

  Percent Heated & Cooled:_ Percent Cooled Only: Percent Heated Only:

  Percent Vacant (Conditioned): Percent Vacant (Unconditioned):

  Percent Unconditioned: Percent Parking Garage:

- Total number of floors above the ground level _____
- Total number of floors below the ground level _____

Notes: _____

Building Specifications:

Exterior Walls:	Wall construction type	
	Wall exterior surface type	
	R-value of insulation material	
Roof:	Roof construction type	
	Roof exterior finish	
	R-value of insulation material	
	Area (Square Feet)	
Floor:	Floor construction type	
	R-value of insulation material	
Windows:	Layers of Glazing 1 = Single, 2 = Double, 3 = Triple	
	Glazing Type	
	Window frame type 1 = Metal 2 = Wood 3 = Other	
	Window U-Value	
	Window SHGF	
Doors:	Door Type 1 = Solid Wood, 2 = Metal Insulated 3 = Other _____.	
	Weather Stripped (Y, N)	

	Wall Types
WFF	2 X 4 Wood Frame Wall
WFM	2 X 4 Metal Frame Wall
WSF	2 X 6 Wood Frame Wall
WSM	2 X 6 Metal Frame Wall
WC4	4" Solid Concrete Wall
WC6	6" Solid Concrete Wall
WBLO	Concrete Block Wall
WBRI	Brick Wall
WGLS	Glass Curtain Wall

	Wall Exterior Surface Types
1	Wood Siding
2	Vinyl Siding
3	Aluminum Siding
4	Stucco
5	Brick
6	Other _____

	Roof/Ceiling Types:
RFAT	Framed With Attic
RMET	Metal Decking
RFNO	Framed Without Attic
RCON	Concrete Decking
RADB	Adiabatic

	Roof Surface Types:
1	Built-up
2	Wood Shingle
3	Metal
4	Clay/Cement Tile
5	Asphalt Roll/shingle

	Floor Types:
1	Slab
2	Crawl
3	Unconditioned Basement
4	Heated Basement
5	Conditioned Basement
6	Other : _____

	Glazing Types:
1	Clear
2	Tinted
3	Reflective
4	Opaque
5	Low E
6	Infrared Reflective
7	Gas Filled

Wall / Window Areas:

	North	**South**	**East**	**West**
Wall Area (Sq.Ft.)				
Window Area (% of Wall Area)				
Interior Window Shading (F : fixed, M : moveable, N : none)				

Packaged Air Distribution Systems (Y / N) Page __ of __

Air Distribution # (Enter A thru I)	# __	# __	# __
Air Distribution system type:			
Thermostat control: 1 = Manual (On/Off) 2 = Constant Temp 3 = Programmable(Night Setback) 4 = Weekly Clock 5 = EMS			
Cooling Equipment type:			
Make			
Model			
Quantity:			
Indoor fan (hp)			
Supply CFM			
Duct Insulation (R-Value)			
Compressor: Volts / Amps / Phase	/ /	/ /	/ /
Capacity Output (kBTU/hr)			
Has the compressor VSD 1=No 2=Yes			
COP			
Economizer (yes/no)			
Heating Equipment type:			
Quantity:			
Fuel Type: 1 = Elect. 2 = Gas.			
Capacity Output (kW or kBTU/hr)			
Heating Equipment Efficiency			
For HP auxiliary heating coil capacity (kW)			
Age of HVAC equipment (years)			

	Packaged Distribution Systems		**Cooling Equip. Types**		**Heating Equip. Types**
EVAP	Evaporative Cooler	DX	Direct Expansion	FC	Furnace
HP	Heat Pump	DXE	DX w/ Evap Cooler	HP	Heat Pump
PTAC	Packaged Terminal Air Conditioner	EC	Evaporative Cooler	EH	Electrical Heat
PSZ	Packaged Single Zone	N/A	Not Applicable	RH	Radiant Heater (Infrared)
PMZ	Packaged Multi Zone			N/A	Not Applicable
PUV	Unit Ventilator				
PVAV	Packaged Variable Air Volume				
PIU	Power Induction Unit				

Notes:

Built-Up Air Distribution Systems (Y / N) Page __ of __

HVAC Air Distribution Systems (Built-up) (Y / N)

Built-up System # (1 thru 9)	# __	# __	# __
Air Distribution system type:			
Thermostat control: 1 = Manual (On/Off) 2 = Constant Temp 3 = Programmable (Night Setback) 4 = Weekly Clock 5 = EMS			
Supply Air:			
Percent of minimum outside air (%)			
Temperature control: 1 =Constant 2 = Reset OAT 3 = Reset Demand			
Total Supply air rate (total CFM per system)			
Total System Supply fan horsepower (fill details in Notes, below)			
Total System Return fan horsepower (fill details in Notes, below)			
Terminal reheat 1 =Electric 2 =Water 3 = None			
Reheat area 1 = Core 2 = Perimeter 3 = Both			
Evaporative pre-cooler 1 = No 2 = Yes			
Economizer (yes / n o)			
The following items are only applicable to VAV systems:			
Minimum CFM Ratio (%)			
VAV Fan Control 1 = Inlet Fan 2 = Variable Speed 3 = Axial Vane 4 = Discharge Damper			
The following items are only applicable to MZS & DDS Systems: Hot Deck Temperature (°F)			
Cold Deck Temperature (°F)			
Duct Insulation (R-Value)			

Built-Up Distribution Systems

SZS	Single Zone System	TPFC	Two Pipe Fan Coil System
MZS	Multi Zone System	FPFC	Four Pipe Fan Coil System
DDS	Dual Duct System	WSHP	Hydronic Heat Pump System
CVS	Constant Volume Reheat Fan System	INDUC	Ceiling Induction Unit
VAV	Variable Air Volume System	FPHS	Floor Panel Heating System
CVAV	Ceiling Bypass VAV System	HVS	Heating And Ventilating System

Notes (Indicate the quantity and corresponding size for supply and return fans):

Page __ of __

Heating Equipment (Built-up) (Y / N)

	# 1	# __	# __
Heating Equipment type:			
Make			
Model			
Fuel type			
Efficiency (%)			
Quantity			
Output Capacity (kBtu/hr)			
Number of units used as back-up			
Serves Air Distribution System number ?	, ,	, ,	, ,

*** Heating equipment type:** 1 = None, 2 = Gas Furnace, 3 = Electric Furnace, 4 = Hot Water Boiler, 5 = Steam Boiler
**** Heating fuel type:** 1 = Electric, 2 = Natural Gas, 3 = Fuel Oil, 4 = LPG, 5 = Wood, 6 = Solar, 7 = Coal/Coke, 8 = Purchased Steam, 9 = Purchased Chilled Water, 10 = Other:_____

Cooling Equipment (Built-up) (Y / N)

	# 1	# __	# __
Cooling Equipment type:			
Make			
Model			
Fuel type			
COP			
Quantity			
Output Capacity (Tons)			
Number of units used as back-up			
Serves Air Distribution System number ?	, ,	, ,	, ,

*** Cooling equipment type :** 1 = Centrifugal Chiller, 2 = Reciprocating Chiller, 3 = Screw Compressor, 4 = Absorption Chiller, 5= Reciprocating DX Compressor, 6 = Hydronic Heat Pump, 7 = Other.
**** Cooling fuel type:** 1 = Electricity, 2 = Gas, 3 = Oil, 4 = LPG, 5 = Wood, 6 = Solar, 7 = Coal/Coke, 8 = Purchased Steam 9 = Purchased Chilled Water, 10 = Other_____

Notes:

Cooling Equipment Load Assignment (Y / N)

	Load Range 1	Load Range 2	Load Range 3	Load Range 4	Load Range 5
Load Range (Tons)	Low _____ High _____.	Low _____ High _____.	Low _____ High _____.	Low _____ High _____.	Low _____ High _____.
Cooling Equipment #	, , , ,	, , , ,	, , , ,	, , , ,	, , , ,
Quantity	, , , ,	, , , ,	, , , ,	, , , ,	, , , ,

Circulation Pumps (Y / N)

	# __	# __	# __
Service Type: 1 = Chilled/Condensor Water 2 = Hot Water 3 = Chilled/Hot Water			
Motor Type: 1 = Fixed Speed 2 = Variable Speed			
Pump power (hp)			
Pump Efficiency			
Quantity			
Serving Heating Equipment # ?			
Serving Cooling Equipment # ?			

Notes

Page __ of __

Cooling Towers (Built-up) (Y / N)

	# __	# __	# __
Fan horsepower (fill details in Notes, below)			
Fan Control 1 = One Speed 2 = Two Speed 3 = Variable			
If Fan Control is Two-speed or Variable speed enter Fan-Low-Ratio $(HP)_L/(HP)_H$			
Temperature Control 1 = Float 2 = Fixed			
Water Set-Point (F)			
Pump Type: 1 = Fixed Speed 2 = Variable Speed			
Pump Horse Power (HP)			
Pump Efficiency			
Quantity			
Serving Cooling Equipment # ?			
Number of units used as back-up			
Tower Cooling Mode 1=N/A 2=Strainer Cycle 3=Thermo Cycle			
Maximum Outdoor Air Temperature			
Maximum Chilled Water Temperature			
Hours the tower is in "free" cooling mode (1-24)	From: __ __ To: __ __	From: __ __ To: __ __	From: __ __ To: __ __

Air Cooled Condenser (Built-up) (Y / N)

	# __	# __	# __
Type: 1 = Air 2 = Evaporative 3 = Air w / pre-cooler			
Fan horsepower (fill details in Notes, below)			
Fan Control 1 = One Speed 2 = Two Speed 3 = Variable			
Temperature Control 1 = Float 2 = Fixed			
Quantity			
Serving Cooling Equipment # ?			
Number of units used as back-up			

Exhaust Fans (Y / N)

	#__	#__	#__
Exhaust Fan Type: 1 = Restroom 2 = General Space 2 = Hood 3 = Kitchen MUA			
Fan power			
Fan capacity			
Quantity			

Notes (Indicate the quantity and corresponding size for fans):

Page __ of __

Water Heating Equipment (Y / N)

	# ____	# ____	# ____
Fuel Type?			
Water Heating Equipment Type 1 = Space Heating Boiler 2 = Individual Water Heater Tank 3 = Instantaneous (Tankless) 4 = Purchased Steam Heat Exchanger 5 = Heat Pump water heater 6 = Boiler (Water Heating only)			
If water is heated by space heating boiler - Heating Equipment #			
Quantity			
Average Capacity (kBtu/hr or kW)			
Tank Capacity (Gallons)			
Is the hot water tank insulated? 1 = No 2 = Yes			
Are hot water pipes insulated? 1 = No 2 = Yes			
Recirculation pump power (hp) - Enter zero for no pump			

Fuel Types:
1 = Electricity6 = Solar
2= Gas7 = Coal/Coke
3 = Oil8 = Purchased Steam
4 = LPG9 = Purchased Chilled Water
5 = Wood10 = Other (describe) _____

Page __ of __

Indoor Lighting

Color Rendition Critical? Y☐ N☐ Security Critical? Y☐ N☐ Light Levels Critical? Y☐ N☐ Footcandles _ _ _

T1: 1 = Recessed 2 = Suspended 3 =Wall 4 = Table/Floor 5 - Ceiling Mounted	Ballast type: 1 = Standard Magnetic 2 = High Efficiency Magnetic 3 = Electronic 4 = Hybrid
T2: 1 = Optical Reflectors 2 = Vented 3 = Both	Control type : 1 = On/Off Switch 2 = Time Clock 3 = Dimmer 4 = Occupancy Sensor 5 = EMS 6 = Photo Cell

Item #	T1	T2	Hi-Eff Lourve/ Lens?	Lamp Type	Control Type	Watts/ Lamp	Ballast Type	# of Lamps/ Fix	% to CF	% to Daylite	% to Occ. Sensor	Count	Total
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										
			Y N										

Lamp Type Code

Code	Name	Code	Name	Code	Name	Code	Name	Code	Name
2F	2 Foot fluorescent	CF	Compact fluorescent	I	Incandescent	L	Low Pressure Sodium	EI	Exit sign, Incandescent
4F	4 foot fluorescent	UT	U-tubes	IR	Incandescent Elliptical Reflector	MV	Mercury Vapor	EF	Exit sign, Fluorescent
6F	6 foot fluorescent	CIR	Circline Fluorescent	IS	Incandescent Spotlight	MH	Metal Halide	EL	Exit sign, LED
8F	8 foot fluorescent	OF	Other fluorescent	Q	Quartz	H	High Pressure Sodium		

Area Type Code

1	Office/Conference	7	Patient Room	13	Cooking	19	Gymnasium, Conditioned
2	Retail	8	Medical Examination Room	14	Laboratory	20	Industrial Processing, Cond.
3	Conditioned Storage	9	Operating or Intensive Care	15	Repair, Conditioned	21	Industrial Process., Uncond.
4	Unconditioned Storage	10	Classroom	16	Library	22	Other, Conditioned
5	Refrig. Storage (<60°F)	11	Hotel Room	17	Vacant, Conditioned	23	Other, Unconditioned
6	Dining Room	12	Public Assembly	18	Hallway/Lobby/Stair, Cond.		

Area ID_____ Area Name _____

		Cold (frozen foods)	Medium (Meat \Dairy)	Warm (Produce)
	REFRIGERATED CASES:			
1	Temperature inside the cases (F)	__ __ __	__ __ __	__ __ __
	CASE TYPES:			
2	Walk-ins (Sq. Ft.)	__ __ __ __ __ __	__ __ __ __ __ __	__ __ __ __ __ __
3	Percent of walk-ins with strip curtains?	__ __ __	__ __ __	__ __
4	Multi-deck open (Ln. Ft.)	__ __ __ __	__ __ __ __	__ __ __ __
5	Multi-deck closed (with doors) (Ln. Ft.)	__ __ __ __	__ __ __ __	__ __ __ __
6	Reach-in open (Ln. Ft.)	__ __ __ __	__ __ __ __	__ __ __ __
7	Reach-in closed (with doors) (Ln. Ft.)	__ __ __ __	__ __ __ __	__ __ __ __
8	if available - Case Load Capacity (tons)	__ __ __ __ __	__ __ __ __	__ __ __ __ __
	CASE EQUIPMENT:			
9	Lights (kW)	__ __ __ __	__ __ __ __	__ __ __ __
10	Fans (kW)	__ __ __ __	__ __ __ __	__ __ __ __
11	Anti-sweat heaters (kW, 0 for none)	__ __ __ __	__ __ __ __	__ __ __ __
	DEFROST:			
12	Type of defrost 1=Elect. 2=Hot Gas 3=Time-off 4=None	__	__	__
13	Defrost control 1=Timer 2=Thermostat	__	__	__
	COMPRESSORS:			
14	Compressor motor type 1=One speed 2=Two speed 3=VSD	__	__	__
15	Compressor motor HP	__ __ __ __	__ __ __ __	__ __ __ __
	Compressor motor:			
	15.1 - Volts , 15.2 - Amps , 15.3 - Phase	, ,	, ,	, ,
16	Is compressor motor high efficient? (1 = No 2 = Yes)	__	__	__
17	Compressor group 1=Common 2=Separate	__	__	__
	CONDENSERS:			
18	Condenser type 1=Air 2=Water 3=Evap. Cond. 4=Evap. Pre-Cooler	__	__	__
19	Condenser location 1=Outdoors 2=Uncond. space 3=Cond. space	__	__	__
20	Fan (kW)	__ __ __ __	__ __ __ __	__ __ __ __
21	Pump (kW)	__ __ __ __	__ __ __ __	__ __ __ __
	HEAT RECOVERY:			
22	Heat recovery for space heating 1=No 2=Yes	__	__	__
23	Heat recovery for water heating 1=No 2=Yes	__	__	__
	REFRIGERATION TECHNOLOGIES:			
24	Floating head pressure 1=No 2=Yes 3=Don't Know	__	__	__
25	Parallel Unequal Compressors 1=No 2=Yes 3=Don't Know	__	__	__
26	Mechanical subcooling 1=No 2=Yes 3=Don't Know	__	__	__
27	Ambient subcooling 1=No 2=Yes 3=Don't Know	__	__	__

In the tables on the next page, fill out the Pre-Retrofit data and the "Anticipated in the absence of the program" data corresponding to the rebated items above.

Notes

APPENDIX C: VALUE OF PERMITS ISSUED FOR NR A&A BY PLACE DURING 2000

List of Permit-Issuing Offices Ranked by Value of Permits Issued during 2000 for Nonresidential Alterations or Additions

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
1	San Francisco	San Francisco	636,186,579	8.8%
2	Los Angeles	Los Angeles	517,407,523	7.1%
3	Santa Clara	San Jose	509,464,600	7.0%
4	San Diego	San Diego	327,614,926	4.5%
5	Santa Clara	Santa Clara	204,906,228	2.8%
6	Santa Clara	Milpitas	204,543,442	2.8%
7	Santa Clara	Sunnyvale	187,896,457	2.6%
8	Orange	Irvine	162,312,721	2.2%
9	Santa Clara	Mountain View	155,337,127	2.1%
10	Los Angeles	El Segundo	117,599,870	1.6%
11	Los Angeles	Los Angeles County Unincorporated Area	109,893,100	1.5%
12	Alameda	Oakland	103,535,742	1.4%
13	Alameda	Fremont	102,142,568	1.4%
14	Santa Clara	Palo Alto	96,140,226	1.3%
15	Sacramento	Sacramento	92,584,393	1.3%
16	San Mateo	Redwood City	74,530,300	1.0%
17	Fresno	Fresno	71,325,695	1.0%
18	Orange	Anaheim	69,912,069	1.0%
19	Placer	Roseville	65,857,613	0.9%
20	Los Angeles	Santa Monica	64,370,437	0.9%
21	Los Angeles	Long Beach	64,317,999	0.9%
22	Contra Costa	San Ramon	63,551,635	0.9%
23	Sacramento	Sacramento County Unincorporated Area	62,440,785	0.9%
24	Orange	Santa Ana	61,959,289	0.9%
25	Alameda	Pleasanton	57,826,996	0.8%
26	Los Angeles	Pasadena	51,967,879	0.7%
27	Orange	Costa Mesa	48,279,000	0.7%
28	San Diego	Carlsbad	44,545,766	0.6%
29	San Bernardino	Ontario	44,386,091	0.6%
30	Santa Clara	Santa Clara County Unincorporated Area	43,656,613	0.6%
31	San Mateo	San Mateo	43,242,621	0.6%
32	San Joaquin	Stockton	43,108,874	0.6%
33	Los Angeles	Glendale	42,549,144	0.6%
34	Alameda	Hayward	39,469,177	0.5%
35	Contra Costa	Richmond	39,341,237	0.5%
36	Alameda	Emeryville	39,070,800	0.5%
37	Santa Clara	Cupertino	37,642,142	0.5%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
38	Orange	Newport Beach	37,533,482	0.5%
39	San Mateo	South San Francisco	37,266,000	0.5%
40	Kern	Bakersfield	34,674,999	0.5%
41	Los Angeles	Industry	33,623,840	0.5%
42	Riverside	Corona	33,482,824	0.5%
43	Los Angeles	Irwindale	33,406,750	0.5%
44	San Diego	Vista	33,401,692	0.5%
45	Alameda	Dublin	33,332,623	0.5%
46	Alameda	Livermore	32,398,718	0.4%
47	Los Angeles	Torrance	30,608,111	0.4%
48	Ventura	Oxnard	29,106,301	0.4%
49	San Mateo	Foster City	29,024,554	0.4%
50	Alameda	Alameda	28,993,897	0.4%
51	Orange	Cypress	27,994,053	0.4%
52	Riverside	Riverside County Unincorporated Area	27,253,412	0.4%
53	Orange	Brea	26,641,112	0.4%
54	Los Angeles	Burbank	26,347,306	0.4%
55	Sacramento	Folsom	25,462,784	0.4%
56	Stanislaus	Modesto	25,011,088	0.3%
57	Los Angeles	Carson	23,900,250	0.3%
58	Contra Costa	Contra Costa County Unincorporated Area	23,402,141	0.3%
59	Napa	Napa County Unincorporated Area	23,187,195	0.3%
60	Orange	Huntington Beach	22,906,486	0.3%
61	Sonoma	Petaluma	22,790,188	0.3%
62	Orange	Lake Forest	22,772,852	0.3%
63	Los Angeles	Cerritos	21,990,590	0.3%
64	Riverside	Riverside	21,943,481	0.3%
65	Ventura	Thousand Oaks	21,818,223	0.3%
66	Riverside	Temecula	21,608,274	0.3%
67	Santa Barbara	Santa Barbara County Unincorporated Area	21,243,164	0.3%
68	Orange	Fullerton	20,993,494	0.3%
69	Los Angeles	Commerce	20,719,700	0.3%
70	San Mateo	San Carlos	20,604,610	0.3%
71	Sonoma	Santa Rosa	20,326,770	0.3%
72	Santa Barbara	Santa Barbara	20,034,599	0.3%
73	Santa Clara	Campbell	19,471,136	0.3%
74	San Bernardino	Rancho Cucamonga	19,407,727	0.3%
75	Contra Costa	Walnut Creek	19,203,371	0.3%
76	Yolo	West Sacramento	18,896,221	0.3%
77	Los Angeles	Culver City	18,833,471	0.3%
78	Los Angeles	Santa Fe Springs	18,440,650	0.3%
79	Alameda	Berkeley	18,423,079	0.3%
80	Alameda	Union City	18,164,797	0.3%
81	Alameda	San Leandro	17,741,287	0.2%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
82	Orange	Orange County Unincorporated Area	17,146,564	0.2%
83	Los Angeles	La Mirada	16,683,740	0.2%
84	San Diego	Poway	16,474,947	0.2%
85	Orange	Mission Viejo	15,963,966	0.2%
86	Orange	Yorba Linda	15,682,261	0.2%
87	Contra Costa	Concord	15,263,581	0.2%
88	Monterey	Salinas	15,203,723	0.2%
89	Fresno	Fresno County Unincorporated Area	15,170,950	0.2%
90	Marin	Novato	14,784,414	0.2%
91	Ventura	Simi Valley	14,680,702	0.2%
92	Los Angeles	Downey	14,243,022	0.2%
93	Kern	Kern County Unincorporated Area	14,068,100	0.2%
94	Sonoma	Sonoma County Unincorporated Area	14,022,900	0.2%
95	Los Angeles	Lakewood	13,951,283	0.2%
96	Los Angeles	Alhambra	13,839,984	0.2%
97	Orange	Orange	13,832,749	0.2%
98	San Diego	El Cajon	13,672,725	0.2%
99	Los Angeles	West Hollywood	13,587,900	0.2%
100	Yolo	Woodland	13,402,564	0.2%
101	Los Angeles	Redondo Beach	13,030,990	0.2%
102	San Joaquin	San Joaquin County Unincorporated Area	12,816,187	0.2%
103	Los Angeles	Santa Clarita	12,485,814	0.2%
104	Orange	Fountain Valley	12,452,087	0.2%
105	San Diego	Oceanside	12,257,185	0.2%
106	Solano	Vacaville	12,247,838	0.2%
107	San Bernardino	Fontana	11,740,265	0.2%
108	Orange	Tustin	11,715,847	0.2%
109	Monterey	Monterey	11,676,827	0.2%
110	Ventura	San Buenaventura	11,583,601	0.2%
111	Orange	Buena Park	11,535,300	0.2%
112	Alameda	Newark	11,510,000	0.2%
113	Monterey	Monterey County Unincorporated Area	11,262,281	0.2%
114	Orange	San Juan Capistrano	11,261,199	0.2%
115	Solano	Vallejo	11,161,742	0.2%
116	Santa Cruz	Watsonville	11,141,058	0.2%
117	Stanislaus	Stanislaus County Unincorporated Area	11,015,803	0.2%
118	Riverside	Palm Springs	11,015,067	0.2%
119	San Mateo	Belmont	10,877,500	0.1%
120	Santa Cruz	Santa Cruz	10,831,274	0.1%
121	Riverside	Palm Desert	10,686,168	0.1%
122	San Diego	Escondido	10,619,891	0.1%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
123	San Diego	Chula Vista	10,527,193	0.1%
124	Los Angeles	Pomona	10,166,787	0.1%
125	San Mateo	Burlingame	10,034,695	0.1%
126	Los Angeles	Arcadia	9,810,180	0.1%
127	Los Angeles	West Covina	9,797,743	0.1%
128	Napa	Napa	9,534,300	0.1%
129	Orange	Westminster	9,503,927	0.1%
130	Tulare	Visalia	9,502,012	0.1%
131	San Mateo	San Bruno	9,340,000	0.1%
132	Santa Clara	Gilroy	9,322,532	0.1%
133	Santa Clara	Los Gatos town	9,283,913	0.1%
134	Solano	Fairfield	9,238,989	0.1%
135	Santa Clara	Morgan Hill	9,195,111	0.1%
136	Placer	Placer County Unincorporated Area	9,191,914	0.1%
137	Sacramento	Citrus Heights	9,076,083	0.1%
138	Humbolt	Eureka	8,846,689	0.1%
139	Orange	Garden Grove	8,816,400	0.1%
140	Los Angeles	Claremont	8,772,524	0.1%
141	Marin	Larkspur	8,750,995	0.1%
142	Stanislaus	Turlock	8,533,569	0.1%
143	Los Angeles	Palmdale	8,402,151	0.1%
144	Ventura	Moorpark	8,385,300	0.1%
145	Contra Costa	Pleasant Hill	8,320,778	0.1%
146	Butte	Chico	8,192,184	0.1%
147	Yolo	Davis	8,076,958	0.1%
148	Tulare	Porterville	8,074,442	0.1%
149	Contra Costa	Pittsburg	7,904,329	0.1%
150	El Dorado	El Dorado County Unincorporated Area	7,803,811	0.1%
151	Los Angeles	Beverly Hills	7,801,435	0.1%
152	Fresno	Clovis	7,648,125	0.1%
153	Los Angeles	El Monte	7,636,204	0.1%
154	Napa	American Canyon	7,599,998	0.1%
155	Shasta	Redding	7,548,710	0.1%
156	Los Angeles	Manhattan Beach	7,537,054	0.1%
157	Merced	Merced	7,400,130	0.1%
158	San Luis Obsipo	San Luis Obispo	7,382,439	0.1%
159	Santa Clara	Los Altos	7,379,383	0.1%
160	Ventura	Camarillo	7,262,414	0.1%
161	Tulare	Tulare County Unincorporated Area	7,210,465	0.1%
162	Los Angeles	Rosemead	7,136,169	0.1%
163	Butte	Oroville	7,125,259	0.1%
164	Riverside	Perris	6,925,687	0.1%
165	Santa Barbara	Lompoc	6,914,113	0.1%
166	Los Angeles	Monrovia	6,876,475	0.1%
167	Los Angeles	Compton	6,841,228	0.1%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
168	San Diego	San Diego County Unincorporated Area	6,791,097	0.1%
169	Santa Barbara	Santa Maria	6,742,611	0.1%
170	Los Angeles	Inglewood	6,738,550	0.1%
171	San Bernardino	San Bernardino County Unincorporated Area	6,673,552	0.1%
172	Marin	Marin County Unincorporated Area	6,540,350	0.1%
173	Los Angeles	Whittier	6,470,603	0.1%
174	Orange	Rancho Santa Margarita	6,463,216	0.1%
175	Los Angeles	Hawthorne	6,079,380	0.1%
176	Contra Costa	Antioch	5,915,211	0.1%
177	Los Angeles	Vernon	5,760,000	0.1%
178	San Bernardino	Chino	5,741,339	0.1%
179	San Bernardino	San Bernardino	5,713,648	0.1%
180	Placer	Auburn	5,679,974	0.1%
181	Los Angeles	Monterey Park	5,597,872	0.1%
182	Sonoma	Sebastopol	5,564,083	0.1%
183	San Diego	San Marcos	5,561,213	0.1%
184	San Luis Obsipo	Atascadero	5,557,023	0.1%
185	Los Angeles	Lancaster	5,530,200	0.1%
186	San Diego	Encinitas	5,401,597	0.1%
187	Los Angeles	Westlake Village	5,359,810	0.1%
188	San Bernardino	Upland	5,195,110	0.1%
189	Los Angeles	Pico Rivera	5,184,000	0.1%
190	Orange	La Habra	5,168,713	0.1%
191	Contra Costa	Danville town	5,154,011	0.1%
192	Sonoma	Rohnert Park	5,145,229	0.1%
193	Marin	San Rafael	5,015,198	0.1%
194	Marin	Sausalito	4,988,757	0.1%
195	Sonoma	Sonoma	4,664,335	0.1%
196	San Joaquin	Tracy	4,557,299	0.1%
197	Riverside	Murrieta	4,545,003	0.1%
198	Riverside	Rancho Mirage	4,544,015	0.1%
199	San Luis Obsipo	San Luis Obispo County Unincorporated Area	4,436,317	0.1%
200	Solano	Solano County Unincorporated Area	4,410,429	0.1%
201	Solano	Benicia	4,346,344	0.1%
202	San Diego	National City	4,253,723	0.1%
203	Marin	Belvedere	4,252,265	0.1%
204	San Diego	La Mesa	4,197,943	0.1%
205	San Mateo	Daly City	4,177,462	0.1%
206	San Joaquin	Manteca	4,157,819	0.1%
207	Los Angeles	Norwalk	4,137,832	0.1%
208	Los Angeles	South Gate	4,096,784	0.1%
209	Los Angeles	Covina	4,095,271	0.1%
210	Santa Cruz	Scotts Valley	4,061,728	0.1%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
211	San Mateo	Menlo Park	4,041,900	0.1%
212	Madera	Madera	3,904,871	0.1%
213	Orange	Dana Point	3,836,292	0.1%
214	Santa Cruz	Capitola	3,832,770	0.1%
215	Butte	Butte County Unincorporated Area	3,813,448	0.1%
216	Kings	Hanford	3,755,641	0.1%
217	San Bernardino	Victorville	3,725,809	0.1%
218	Napa	St. Helena	3,715,734	0.1%
219	Orange	San Clemente	3,715,393	0.1%
220	Orange	Los Alamitos	3,695,250	0.1%
221	Santa Clara	Saratoga	3,690,070	0.1%
222	Mendicino	Mendocino County Unincorporated Area	3,600,144	0.0%
223	Los Angeles	Diamond Bar	3,517,600	0.0%
224	Los Angeles	Gardena	3,500,000	0.0%
225	San Bernardino	Chino Hills	3,329,000	0.0%
226	Riverside	Moreno Valley	3,325,247	0.0%
227	Placer	Lincoln	3,322,355	0.0%
228	Kings	Lemoore	3,303,630	0.0%
229	El Dorado	South Lake Tahoe	3,164,613	0.0%
230	Los Angeles	Agoura Hills	3,029,541	0.0%
231	Fresno	Reedley	3,019,046	0.0%
232	Humbolt	Humboldt County Unincorporated Area	3,002,879	0.0%
233	Orange	Placentia	2,977,903	0.0%
234	Orange	Laguna Niguel	2,899,657	0.0%
235	Sacramento	Galt	2,862,600	0.0%
236	San Bernardino	Montclair	2,861,960	0.0%
237	San Joaquin	Lodi	2,859,090	0.0%
238	San Bernardino	Rialto	2,803,060	0.0%
239	San Luis Obsipo	Paso Robles	2,793,098	0.0%
240	Los Angeles	Malibu	2,694,516	0.0%
241	San Luis Obsipo	Arroyo Grande	2,673,777	0.0%
242	San Joaquin	Lathrop	2,673,067	0.0%
243	Contra Costa	Martinez	2,628,000	0.0%
244	Sutter	Yuba City	2,606,164	0.0%
245	Placer	Rocklin	2,606,054	0.0%
246	San Mateo	San Mateo County Unincorporated Area	2,579,907	0.0%
247	San Diego	Santee	2,577,162	0.0%
248	Los Angeles	Bellflower	2,575,416	0.0%
249	San Mateo	Colma town	2,550,329	0.0%
250	Calaveras	Calaveras County Unincorporated Area	2,514,173	0.0%
251	Riverside	Hemet	2,506,990	0.0%
252	San Benito	Hollister	2,462,082	0.0%
253	Los Angeles	Baldwin Park	2,454,164	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
254	Los Angeles	Lomita	2,432,370	0.0%
255	Orange	Laguna Hills	2,428,788	0.0%
256	Los Angeles	Calabasas	2,425,734	0.0%
257	Butte	Gridley	2,347,450	0.0%
258	Orange	Laguna Beach	2,313,680	0.0%
259	San Bernardino	Apple Valley town	2,303,516	0.0%
260	Los Angeles	Duarte	2,278,480	0.0%
261	Sonoma	Healdsburg	2,267,629	0.0%
262	San Bernardino	Redlands	2,251,290	0.0%
263	Humbolt	Arcata	2,237,502	0.0%
264	San Diego	Solana Beach	2,233,200	0.0%
265	Siskiyou	Siskiyou County Unincorporated Area	2,187,736	0.0%
266	Stanislaus	Oakdale	2,181,615	0.0%
267	Alameda	Alameda County Unincorporated Area	2,121,978	0.0%
268	Stanislaus	Ceres	2,113,951	0.0%
269	Yuba	Marysville	2,102,437	0.0%
270	Los Angeles	Montebello	2,062,500	0.0%
271	Madera	Madera County Unincorporated Area	2,042,395	0.0%
272	Los Angeles	Rancho Palos Verdes	1,979,000	0.0%
273	Sutter	Live Oak	1,962,000	0.0%
274	Fresno	Parlier	1,905,380	0.0%
275	Yuba	Yuba County Unincorporated Area	1,900,707	0.0%
276	Tuolumne	Tuolumne County Unincorporated Area	1,892,726	0.0%
277	Merced	Merced County Unincorporated Area	1,834,675	0.0%
278	San Bernardino	Adelanto	1,833,361	0.0%
279	Ventura	Ventura County Unincorporated Area	1,821,481	0.0%
280	San Mateo	Pacifica	1,811,882	0.0%
281	Los Angeles	South Pasadena	1,806,853	0.0%
282	Marin	Tiburon town	1,795,000	0.0%
283	Los Angeles	Huntington Park	1,790,955	0.0%
284	Santa Cruz	Santa Cruz County Unincorporated Area	1,781,376	0.0%
285	Shasta	Shasta County Unincorporated Area	1,781,007	0.0%
286	Los Angeles	Paramount	1,777,875	0.0%
287	Los Angeles	La Canada Flintridge	1,768,770	0.0%
288	Stanislaus	Riverbank	1,758,596	0.0%
289	Los Angeles	Glendora	1,757,444	0.0%
290	Orange	La Palma	1,737,879	0.0%
291	Orange	Seal Beach	1,705,602	0.0%
292	Ventura	Ojai	1,686,672	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
293	Monterey	Del Rey Oaks	1,679,763	0.0%
294	Yolo	Yolo County Unincorporated Area	1,664,901	0.0%
295	San Bernardino	Barstow	1,663,449	0.0%
296	Tehama	Corning	1,659,343	0.0%
297	Mendicino	Ukiah	1,613,288	0.0%
298	Los Angeles	Signal Hill	1,550,000	0.0%
299	Los Angeles	Hermosa Beach	1,532,056	0.0%
300	Solano	Suisun City	1,515,605	0.0%
301	Contra Costa	Brentwood	1,514,316	0.0%
302	Del Norte	Del Norte County Unincorporated Area	1,513,117	0.0%
303	Riverside	Indian Wells	1,499,484	0.0%
304	San Bernardino	Big Bear Lake	1,476,056	0.0%
305	Los Angeles	San Dimas	1,475,885	0.0%
306	Monterey	Pacific Grove	1,472,985	0.0%
307	Los Angeles	Temple City	1,436,330	0.0%
308	Riverside	Cathedral City	1,401,960	0.0%
309	Kings	Kings County Unincorporated Area	1,340,693	0.0%
310	Marin	Corte Madera town	1,315,025	0.0%
311	Marin	Mill Valley	1,246,895	0.0%
312	Los Angeles	San Fernando	1,232,804	0.0%
313	Marin	San Anselmo town	1,211,530	0.0%
314	Riverside	Banning	1,208,786	0.0%
315	San Joaquin	Escalon	1,200,262	0.0%
316	Riverside	Coachella	1,183,277	0.0%
317	Imperial	Calexico	1,176,910	0.0%
318	Riverside	La Quinta	1,143,111	0.0%
319	Orange	Stanton	1,139,840	0.0%
320	Contra Costa	Pinole	1,132,550	0.0%
321	Los Angeles	La Verne	1,086,437	0.0%
322	Los Angeles	South El Monte	994,900	0.0%
323	San Bernardino	Yucca Valley	982,455	0.0%
324	San Luis Obsipo	Pismo Beach	975,200	0.0%
325	San Diego	Coronado	970,510	0.0%
326	Los Angeles	Bell	933,091	0.0%
327	Kern	Ridgecrest	920,466	0.0%
328	Fresno	Kerman	912,000	0.0%
329	Riverside	Indio	889,444	0.0%
330	Butte	Paradise town	885,841	0.0%
331	Imperial	El Centro	885,100	0.0%
332	Amador	Amador County Unincorporated Area	883,503	0.0%
333	San Bernardino	Loma Linda	879,549	0.0%
334	San Luis Obsipo	Grover Beach	857,802	0.0%
335	Tulare	Tulare	856,515	0.0%
336	Los Angeles	Artesia	845,850	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
337	San Mateo	Woodside town	830,312	0.0%
338	San Mateo	Half Moon Bay	772,000	0.0%
339	Santa Barbara	Carpinteria	767,796	0.0%
340	Sonoma	Windsor town	748,076	0.0%
341	Sutter	Sutter County Unincorporated Area	745,063	0.0%
342	Los Angeles	Lawndale	742,310	0.0%
343	Kern	Delano	742,200	0.0%
344	Riverside	Lake Elsinore	726,341	0.0%
345	Ventura	Port Hueneme	723,292	0.0%
346	Merced	Atwater	714,477	0.0%
347	Inyo	Inyo County Unincorporated Area	697,479	0.0%
348	Lake	Lake County Unincorporated Area	681,600	0.0%
349	Los Angeles	Lynwood	680,800	0.0%
350	Imperial	Imperial County Unincorporated Area	648,457	0.0%
351	Solano	Dixon	640,400	0.0%
352	Los Angeles	Rolling Hills Estates	640,300	0.0%
353	San Bernardino	Yucaipa	636,374	0.0%
354	Riverside	Norco	620,745	0.0%
355	San Bernardino	Highland	611,575	0.0%
356	Modoc	Alturas	564,927	0.0%
357	Imperial	Imperial	551,821	0.0%
358	Ventura	Santa Paula	550,028	0.0%
359	Monterey	King City	546,962	0.0%
360	Plumas	Plumas County Unincorporated Area	544,543	0.0%
361	San Benito	San Benito County Unincorporated Area	540,498	0.0%
362	Tulare	Lindsay	535,935	0.0%
363	Siskiyou	Yreka	533,846	0.0%
364	Riverside	San Jacinto	528,528	0.0%
365	San Mateo	Millbrae	516,000	0.0%
366	Imperial	Brawley	508,462	0.0%
367	Merced	Los Banos	502,204	0.0%
368	Los Angeles	La Puente	497,340	0.0%
369	Lake	Lakeport	469,870	0.0%
370	Kern	Shafter	468,371	0.0%
371	San Bernardino	Twentynine Palms	456,688	0.0%
372	Tehama	Tehama County Unincorporated Area	456,055	0.0%
373	Monterey	Carmel-by-the-Sea	447,000	0.0%
374	Los Angeles	Hawaiian Gardens	443,992	0.0%
375	Alameda	Albany	432,000	0.0%
376	San Mateo	East Palo Alto	404,950	0.0%
377	Los Angeles	San Gabriel	398,000	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
378	Napa	Calistoga	396,356	0.0%
379	Monterey	Seaside	395,307	0.0%
380	Riverside	Blythe	388,039	0.0%
381	San Bernardino	Grand Terrace	382,269	0.0%
382	Alpine	Alpine County	370,444	0.0%
383	Alameda	Piedmont	368,600	0.0%
384	Shasta	Anderson	366,339	0.0%
385	Trinity	Trinity County	364,161	0.0%
386	Mono	Mono County Unincorporated Area	363,600	0.0%
387	Mono	Mammoth Lakes town	354,518	0.0%
388	Kings	Avenal	347,428	0.0%
389	San Joaquin	Ripon	341,923	0.0%
390	Kern	Taft	339,900	0.0%
391	Glenn	Glenn County Unincorporated Area	331,731	0.0%
392	Humbolt	Fortuna	320,528	0.0%
393	Merced	Gustine	319,148	0.0%
394	San Bernardino	Hesperia	314,945	0.0%
395	Los Angeles	Bell Gardens	312,949	0.0%
396	Contra Costa	San Pablo	308,777	0.0%
397	San Diego	Lemon Grove	306,445	0.0%
398	Nevada	Truckee	300,000	0.0%
399	Tehama	Red Bluff	291,746	0.0%
400	Inyo	Bishop	284,600	0.0%
401	Siskiyou	Weed	281,162	0.0%
402	Placer	Loomis town	275,738	0.0%
403	Sonoma	Cloverdale	269,600	0.0%
404	Solano	Rio Vista	267,596	0.0%
405	Del Norte	Crescent City	261,870	0.0%
406	Monterey	Soledad	255,922	0.0%
407	Tulare	Dinuba	242,042	0.0%
408	San Mateo	Atherton town	240,000	0.0%
409	Fresno	Kingsburg	235,925	0.0%
410	Fresno	Sanger	233,650	0.0%
411	Nevada	Nevada County Unincorporated Area	231,953	0.0%
412	Mariposa	Mariposa County	217,664	0.0%
413	Riverside	Desert Hot Springs	216,338	0.0%
414	Marin	Fairfax town	214,200	0.0%
415	Contra Costa	El Cerrito	207,500	0.0%
416	Ventura	Fillmore	206,916	0.0%
417	Tuolumne	Sonora	206,580	0.0%
418	San Luis Obsipo	Morro Bay	205,192	0.0%
419	Kern	Wasco	204,810	0.0%
420	Amador	Jackson	204,637	0.0%
421	Los Angeles	Walnut	203,347	0.0%
422	Los Angeles	Maywood	192,000	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
423	Yolo	Winters	188,329	0.0%
424	Colusa	Williams	188,000	0.0%
425	Placer	Colfax	183,370	0.0%
426	Los Angeles	Sierra Madre	180,000	0.0%
427	Tulare	Exeter	172,500	0.0%
428	Merced	Livingston	160,650	0.0%
429	Siskiyou	Mount Shasta	160,000	0.0%
430	Los Angeles	Avalon	152,000	0.0%
431	Stanislaus	Newman	151,874	0.0%
432	Lassen	Susanville	149,142	0.0%
433	Tulare	Farmersville	144,806	0.0%
434	San Diego	Del Mar	144,143	0.0%
435	El Dorado	Placerville	140,460	0.0%
436	Sonoma	Cotati	135,171	0.0%
437	Plumas	Portola	126,480	0.0%
438	Lassen	Lassen County Unincorporated Area	125,435	0.0%
439	Fresno	Mendota	120,000	0.0%
440	San Diego	Imperial Beach	119,872	0.0%
441	Imperial	Holtville	114,766	0.0%
442	Fresno	Selma	111,600	0.0%
443	Glenn	Willows	109,763	0.0%
444	Mendicino	Fort Bragg	105,876	0.0%
445	Riverside	Beaumont	101,000	0.0%
446	Monterey	Sand City	97,500	0.0%
447	Kings	Corcoran	95,182	0.0%
448	Fresno	Coalinga	93,840	0.0%
449	Kern	California City	89,900	0.0%
450	Mendicino	Willits	89,000	0.0%
451	Los Angeles	Cudahy	86,126	0.0%
452	Yuba	Wheatland	85,353	0.0%
453	San Bernardino	Needles	81,800	0.0%
454	Fresno	Firebaugh	76,260	0.0%
455	Fresno	Fowler	74,676	0.0%
456	Fresno	Huron	70,700	0.0%
457	Stanislaus	Patterson	69,000	0.0%
458	Kern	Arvin	65,885	0.0%
459	Los Angeles	Rolling Hills	61,500	0.0%
460	San Mateo	Brisbane	60,000	0.0%
461	Riverside	Calimesa	58,837	0.0%
462	Los Angeles	Bradbury	54,000	0.0%
463	Napa	Yountville town	53,839	0.0%
464	Colusa	Colusa	52,000	0.0%
465	Monterey	Marina	50,000	0.0%
466	San Bernardino	Colton	49,071	0.0%
467	Modoc	Modoc County Unincorported Area	48,100	0.0%
468	Monterey	Gonzales	45,000	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
469	Glenn	Orland	43,700	0.0%
470	Stanislaus	Hughson	32,000	0.0%
471	Contra Costa	Hercules	30,000	0.0%
472	Colusa	Colusa County Unincorporated Area	25,000	0.0%
473	Fresno	Orange Cove	24,380	0.0%
474	Siskiyou	Montague	20,700	0.0%
475	Nevada	Grass Valley	20,000	0.0%
476	Los Angeles	La Habra Heights	15,414	0.0%
477	Shasta	Shasta Lake	14,500	0.0%
478	Orange	Laguna Woods	12,000	0.0%
479	Orange	Villa Park	12,000	0.0%
480	Amador	Ione	11,300	0.0%
481	Imperial	Westmorland	7,192	0.0%
482	Siskiyou	Dorris	7,000	0.0%
483	Siskiyou	Dunsmuir	6,500	0.0%
484	San Mateo	Portola Valley town	6,000	0.0%
485	Siskiyou	Etna	6,000	0.0%
486	Sierra	Sierra County Unincorporated Area	2,000	0.0%
487	Contra Costa	Oakley	1,500	0.0%
488	Siskiyou	Tulelake	1,500	0.0%
489	Amador	Amador City	-	0.0%
490	Amador	Plymouth	-	0.0%
491	Amador	Sutter Creek	-	0.0%
492	Calaveras	Angels	-	0.0%
493	Fresno	San Joaquin	-	0.0%
494	Humbolt	Blue Lake	-	0.0%
495	Humbolt	Ferndale	-	0.0%
496	Humbolt	Rio Dell	-	0.0%
497	Humbolt	Trinidad	-	0.0%
498	Imperial	Calipatria	-	0.0%
499	Kern	Maricopa	-	0.0%
500	Los Angeles	Azusa	-	0.0%
501	Los Angeles	Hidden Hills	-	0.0%
502	Los Angeles	Palos Verdes Estates	-	0.0%
503	Los Angeles	San Marino	-	0.0%
504	Madera	Chowchilla	-	0.0%
505	Marin	Ross town	-	0.0%
506	Merced	Dos Palos	-	0.0%
507	Monterey	Greenfield	-	0.0%
508	Riverside	Canyon Lake	-	0.0%
509	Sacramento	Isleton	-	0.0%
510	San Benito	San Juan Bautista	-	0.0%
511	San Mateo	Hillsborough town	-	0.0%
512	Santa Barbara	Guadalupe	-	0.0%
513	Santa Clara	Los Altos Hills town	-	0.0%
514	Santa Clara	Monte Sereno	-	0.0%

Rank	*County*	*Place*	*Value of Permits Issued for NR A&A*	*Value as Percent of Total Value*
515	Sierra	Loyalton	-	0.0%
516	Siskiyou	Fort Jones	-	0.0%
517	Stanislaus	Waterford	-	0.0%
518	Tulare	Woodlake	-	0.0%

Source: Construction Industry Research Board