FINAL REPORT

STATEWIDE SURVEY OF MULTI-FAMILY COMMON AREA BUILDING OWNERS MARKET

Volume I: Apartment Complexes

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Market Assessment
and Evaluation Study

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FOREWORD

Under contract with Southern California Edison Company (SCE), ADM Associates, Inc. (ADM) and TecMRKT Works LLC have conducted a statewide survey of the multi-family common area/building owners market in California. This project was initiated as one of the market assessment and evaluation (MA&E) efforts of the California utilities to collect baseline data on measures and market actor attitudes. The survey was conducted in the service areas of Pacific Gas and Electric, Southern California Edison, Southern California Gas, and San Diego Gas and Electric.

Dr. Shahana Samuillah of Southern California Edison was the Project Manager for the survey. ADM was the prime contractor for the project. It performed the on-site and telephone survey work to collect the data for the study and prepared the estimates of common area equipment saturations. TecMRKT Works was a subcontractor to ADM. It conducted in-depth in-person interviews with key professionals in the multi-family industry, analyzed the information from the interviews, led the design of the survey instrument for the large-scale telephone survey, and prepared the analysis of the attitudinal/behavioral market characterization aspects of the study.

The project had two major components. One component was a study of common areas for condominium/homeowner associations throughout California, and the other component was a study of common areas for apartment complexes. The results of the study therefore are reported in two separate volumes. Volume I presents and discusses the results from the study of apartment complex common areas. Volume II presents and discusses the results of the study of common areas for condominium and homeowner associations.

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EXECUTIVE SUMMARY

A statewide survey of the common areas for multi-family housing has been undertaken to provide information about the levels of energy efficiency already being achieved for the common areas of such housing, about the decision-making processes among owners/managers of multi-family housing properties, and about the potential for programs to further improve energy efficiency in common areas of multi-family housing. The survey effort was directed at providing information for determining the baseline level of saturation of measures in common areas and for facilitating the planning of retrofit and renovation/remodeling (R&R) market transformation programs for the California state market.

The survey was focused on common areas of multi-family housing, including apartment complexes and condominium and homeowner associations. The survey results for apartment complexes are reported in this volume.

Data regarding energy use for common area equipment for apartment complexes were collected through several means.

- In-depth in-person interviews were conducted with 25 key professionals in the multi-family industry.
- Data on energy-using equipment for common areas were collected on-site for a sample of 540 apartment complexes located throughout the state of California.
- Decision-makers for the apartment complexes that were surveyed on-site were interviewed by telephone to obtain information on decision-making procedures and on their attitudes and perceptions regarding energy efficiency for their facilities. Interviews were completed with decision makers for 420 apartment complexes.

The data collection effort produced information regarding the structure of the apartment complex market, the characteristics of the apartment complexes, the decision making for common areas (including equipment selection), the energy efficiency characteristics of common area equipment, and the potential for and barriers to making energy efficiency improvements for common areas of the apartment complexes.

CHARACTERISTICS OF APARTMENT COMPLEX MARKET

There are an estimated 28,650 apartment complexes in the combined service areas of Pacific Gas and Electric, Southern California Edison, Southern California Gas, and San Diego Gas and Electric. These complexes have 2.89 million apartment units. About 70 percent of the complexes were built in the 1970s and 1980s, while just 7 percent were built in the 1990s.

Players in the California apartment market vary with respect to size, ranging from owners who may have a duplex or a few apartments to large international corporations that own 20,000 or more units in California and large numbers of other units elsewhere in the US and the world.

- About a quarter of all multifamily units are owned or managed by companies that deal with 5,000 or more units and 50 or more complexes. The overall organizational structure can be very complex for these large companies. At the pinnacle of the structure is the owner or the owners who play an active role in the company or a president or CEO representing investors. There is usually a group of senior managers, with titles such as Vice President, who are responsible for financial management, development, operations, planning, purchasing, and acquisitions.
- Medium-size companies typically own or manage between 250 and 5,000 units. Owners are the key players with respect to acquisition and retention of properties. They play an important role in setting policy. They may be more or less involved in day-to-day management of properties depending on the size of the firm. As the number of units drops below 1,000, owners may have a broader range of responsibilities and more day-to-day oversight of properties.
- Small companies have fewer than 1,000 units in one or more buildings and complexes. These smallest companies usually have properties with relatively small numbers of units. Operators at this level either contract with a management firm or manage the units on their own. Those who contract management are likely to use a medium-size management company. For small firms with more and larger units, the organizational form begins to approximate that of medium-size companies.

HIGHLIGHTS REGARDING ENERGY-USING EQUIPMENT FOR COMMON AREAS OF APARTMENT COMPLEXES

The survey produced information regarding energy-using equipment for common areas of apartment complexes.

Outdoor Lighting

Outdoor lighting is used at apartment complexes for parking lots, entries, walkways, stairways, and landscaping. Based on lamp wattages, the connected load for outdoor lighting at apartment complexes was estimated to be 210.2 mW. Six types of lighting account for about 82 percent of the connected outdoor lighting load. The predominant type of outdoor lighting is incandescent, which accounts for 37 percent of the connected load. Other common types of outdoor lighting include high pressure sodium (12 percent of the connected load), four-foot fluorescent (12 percent), pin-based compact fluorescent (11 percent), mercury vapor (7 percent), and metal halide (3 percent).

Indoor Lighting

The connected load for lighting indoor common areas at apartment complexes is less than for lighting outdoor common areas. The connected load for lighting indoor common areas was estimated to be 70.0 mW for the combined service areas. Six types of lighting account for 94 percent of the connected indoor lighting load. The predominant type of indoor lighting is four-foot fluorescent, which accounts for 45 percent of the connected load. Other common types of indoor lighting include incandescent (31 percent of the connected load), pin-based compact fluorescent (7 percent), eight-foot fluorescent (4 percent), CircleLine fluorescent (4 percent), and incandescent exit signs (3 percent).

Laundry Equipment

There is common area laundry equipment at about 92 percent of the apartment complexes. The overall estimated stock of laundry equipment at apartment complexes consists of about 235,910 clothes washers and 235,380 dryers. Nearly all of the common area washers and dryers are coin-operated. However, there are several types of arrangements by which the revenue from the machines is distributed. About 58 percent of the coin-operated washers and dryers are operated under a revenue distribution arrangement whereby the apartment complex shares the revenue with the company that provides the laundry equipment.

Most common area clothes washers at apartment complexes are top-loaded, with vertical agitators. Most of the washers are electric, drawing 1 kW or less. Most common area clothes dryers are front-loaded. About 91 percent of the clothes dryers use natural gas, while about 9 percent use electricity.

About 13 percent of washers and dryers are under one year old, about 54 percent are between one and five years old, and about 27 percent are over five years old. (Age was not determinable for about 5 percent.)

Swimming Pools and Hot Tubs

Just over three-fourths (77 percent) of the apartment complexes have one or more swimming pools. There is a total of 25,960 swimming pools at the complexes. Most of these swimming pools are outdoors. About 56 percent of the pools are not heated, while about 44 percent are heated, mostly with natural gas heating.

Hot tubs are found at fewer of the apartment complexes than are swimming pools. Just over one third (35 percent) of the apartment complexes have one or more hot tubs. The estimated number of hot tubs is about 10,380. Most of these hot tubs are outdoors and are heated using natural gas.

Water Heating Equipment

The stock of common area water heating equipment at apartment complexes is estimated to be 173,980 pieces of equipment. Nearly 90 percent of the water heating equipment is fired by natural gas, while about 8 percent of the equipment uses electricity to heat the water. The type of equipment used most commonly to provide hot water to common areas is a natural-gas water heater with a tank. Such equipment accounts for about 77 percent of the installed stock of water heating equipment.

Heating or Cooling Equipment

About two thirds (67 percent) of the apartment complexes have some type of package unit heating or cooling equipment for common areas. Only a few complexes were observed to have built-up heating or cooling equipment.

DECISION MAKING PRACTICES FOR COMMON AREAS OF APARTMENT COMPLEXES

The person most often identified as the key decision maker for common area equipment requirements for an apartment complex is the site manager. However, the decision maker varies depending on the characteristics of the apartment operator's organization.

From a programmatic perspective, site managers and owners are the primary targets, with senior housing managers and maintenance supervisors also being important. For small companies that own few and/or small complexes, owners should be the key target. For large management corporations with large sites and many complexes, the target should be senior housing managers. For corporations that own and manage large sites and large complexes, the target should be senior off-site housing managers. Site managers are frequent targets but should especially be targeted when they represent a firm with smaller and fewer complexes.

Sources of Information

The key sources of information that decision makers for apartment complexes use to support their common area equipment decisions are contractors (cited by decision makers for 55 percent of the complexes) and internal maintenance staff (cited by decision makers for 41 percent of the complexes). Distributors and manufacturers are less often used as sources of information. Trade publications and utility companies are cited as sources least often. For example, utilities were cited as a source of information by about 8 percent of the complexes.

Based on the survey results, it is estimated that third party developers (e.g., energy services companies) have offered products or service to about 13 percent of the apartment complexes in California, with about 6 percent having accepted the offer. Third party offerings were more successful when presented to owner-operated firms than when

presented to contract-operated complexes. A key reason why offers were not accepted was that operators did not believe the savings claims.

Equipment Selection

Decision makers rate reliability as the most important decision criterion in purchasing equipment for common areas. Energy costs when the company pays for the energy, energy efficiency, and ease of maintenance were also rated as important. First cost is well down the list. From a programmatic perspective, programs need to focus more on reliability and avoid recommending equipment and technologies with low reliability. However, interest in energy costs and efficiency does increase as the number of units at a complex increases and the total number of units a firm has increases.

Operators for about half of the apartment complexes claimed to have made energy efficiency improvements to their complexes. Most of these improvements were for outdoor or indoor lighting. With the exception of swimming pools, 83 percent or more of the respondents cited energy efficiency as the motivation for making the improvements. Reducing company operating cost was typically cited as a reason for making the changes half as often. Thus, more than half of those who are making changes are making them for reasons of energy efficiency but not for reducing operating cost. These differences are dramatic and suggest that many decision makers are electing energy efficiency for reasons other than cost.

Role of Utility Programs

About 16 percent of apartment operators said that they had participated in energy efficiency programs sponsored by California utilities. Representatives of apartment managers indicated that they were more likely to have participated than owners were. Programs had been used more often in older complexes. Larger operators were more likely to have used programs than smaller ones.

Plans for Energy Efficiency Improvements

Survey results indicate that about a fourth of the apartment complexes are planning to make changes in the next three years. The most common change that is anticipated is to renovate a complex or replace obsolete features. It is the larger firms that have plans to remodel. This potentially represents a significant opportunity to upgrade the efficiency of existing apartment dwellings.

Although the focus of the study is on common areas for apartment complexes, information was also collected regarding decisions that apartment operators might make with respect to their purchasing of appliances for tenant units. More than half of the operators buy appliances through pre-negotiated contracts, with about 40 percent selecting and buying from available stock. The most common source of appliances is a

local distributor or wholesaler, followed by a manufacturer or a manufacturers distributor. Reliability is the most important decision criterion to apartment operators in buying appliances for units. It is followed closely by energy costs when the company pays, energy efficiency and ease of maintenance.

1. INTRODUCTION

This report presents and discusses the results from a survey of common areas for apartment complexes throughout California. The reasons for the survey and the methodology used are summarized here.

1.1 BACKGROUND

Compared to other market segments, there is relatively less information on the saturation of energy end-use equipment and their efficiency levels in the common areas for multi-family dwellings. Moreover, the attitudes and decision-making processes of multi-family building owners and managers have been less studied. Accordingly, the purpose of the statewide survey of the multi-family common area/building owners market was to provide more information about the levels of energy efficiency already being achieved in the multi-family housing market segment, about the decision-making processes among owners/managers of multi-family housing properties, and about the potential for programs to further improve energy efficiency in common areas of multi-family housing. The survey effort was directed at providing information for determining the baseline level of saturation of measures in common areas and for facilitating the preparation of retrofit and renovation/remodeling (R&R) market transformation programs for the California state market.

1.2 OVERVIEW OF STUDY METHODOLOGY

Because common areas of multi-family facilities and complexes have not received much attention in previous studies, performing this survey presented challenges. The characteristics of the common areas of multi-family facilities are less well known than for residential, commercial, or industrial facilities, and there are less data available to inform the design of a survey of common areas. However, several data sources were identified that permitted fine-tuning the sample design for surveying apartment complexes in the state. These data sources were used to develop the sampling and surveying plan.

The data collection effort for the survey included the following:

- In-depth in-person interviews were conducted with 25 key professionals in the multi-family industry. The persons interviewed included large and small property owners, large and small property managers, heads of homeowners associations, on-site property managers, and building professionals such as architects, engineers, and others, serving the multi-housing industry. The interviews were conducted in different regions in California to capture indicators of regional differences.
- Data on the common areas for apartment complexes were collected on-site for a sample of 541 apartment complexes located in the service areas of Pacific Gas and

Electric, Southern California Edison, Southern California Gas, and San Diego Gas and Electric throughout the state.

- Decision-makers for the apartment complexes that were surveyed on-site were interviewed by telephone to obtain information on decision-making procedures and on their attitudes, perceptions and practices regarding energy efficiency for their facilities. Interviews were completed with decision makers for 420 apartment complexes.

For purposes of analysis, the data for the surveyed complexes were statistically weighted to represent the population of apartment complexes in each of the utility service areas. The weighted data were used to develop characterizations of the market for common area equipment for apartment complexes, to determine the attitudes and behavior of market actors, and to prepare estimates of the saturations of common area energy-using equipment.

1.3 SUMMARY OF RESULTS

Major conclusions from the study of common areas for apartment complexes are briefly summarized here.

1.3.1 Market Structure

High proportions of the operators of apartments operate entirely within California. About half of these have business lines other than commercial apartments, most notably commercial real estate. The largest proportion of complexes was built in the 1970s, with the number of complexes built in the 1990s is about a fifth of those built in the 1970s. We attribute this to the severe decline in the economy in California in the early 1990s.

The number of complexes varies by service territory. Complexes in the SCE/SCG service area are somewhat larger than those in the PG&E and SDG&E service areas. Complexes built in the 1980s have more units than complexes in other decades. There is a preponderance of two bedroom units (46 percent) followed by one bedroom units (41 percent).

Average monthly rents range from a low of $701 to a high of $1,057 in all complexes. Average rents are the highest in the SCE service territory. Average rents are lower for complexes where rents are controlled than for complexes where rents are not controlled.

1.3.2 Decision Makers and Decision Making

The person most often identified as the key decision maker for common area equipment requirements is the site manager. However, the decision maker varies depending on the characteristics of the apartment operator's organization.

From a programmatic perspective, site managers and owners are the primary targets, with senior housing managers and maintenance supervisors also being important. For small companies that own few and/or small complexes, owners should be the key target. For large management corporations with large sites and many complexes, the target should be senior housing managers. For corporations that own and manage large sites and large complexes, the target should be senior off-site housing managers. Site managers are frequent targets but should especially be targeted when they represent a firm with smaller and fewer complexes.

Decision makers rate reliability as the most important decision criterion in purchasing equipment. Energy costs when the company pays for the energy, energy efficiency, and ease of maintenance were also rated as important. First cost is well down the list. From a programmatic perspective, programs need to focus more on the reliability and avoid recommending equipment and technologies with low reliability. However, interest in energy costs and efficiency does increase as the number of units at a complex increases and the total number of units a firm has increases.

Based on the survey results, it is estimated that third party developers have offered products or service to about 13 percent of the apartment complexes in California, with about 6 percent having accepted the offer. Third party offerings were more successful when presented to owner-operated firms than when presented to contract-operated complexes. A key reason why offers were not accepted was that operators did not believe the savings claims.

1.3.3 Common Area Energy-Using Equipment and Efficiency Levels

Estimates of the amount of energy-using equipment installed in common areas of apartment complexes were prepared for the following:

- Lighting for outdoor common areas
- Lighting for indoor common areas
- Common area laundry equipment
- Swimming pools and hot tubs
- Water heating equipment for common areas
- Heating and cooling equipment for common areas
- Miscellaneous equipment in common areas

Summary tables for these types of equipment are included in Chapter 5, with detailed tables included in Appendix C.

1.3.4 Energy Efficiency Improvements

Operators for about half of the apartment complexes claimed to have made energy efficiency improvements to their complexes. Most of these were for outdoor or indoor lighting. With the exception of swimming pools, 83 percent or more of the respondents cited energy efficiency as the motivation for making the improvements. Reducing company operating cost was typically cited as a reason for making the changes half as often. Thus, more than half of those who are making changes are making them for reasons of energy efficiency but not for reducing operating cost. These differences are dramatic and suggest that many decision makers are electing energy efficiency for reasons other than cost.

From a program perspective, it is important to recognize that decision makers may not see the connection between energy efficiency and reducing energy costs. Another possibility is that the total cost of energy in a complex is not a very strong incentive to improve energy efficiency. The promotion of energy efficiency improvements may be more successful if they are promoted for other reasons. It may be more effective to promote equipment changes for reasons such as safety, reliability and replacing poorly working equipment.

About 16 percent of apartment operators said that they had participated in energy efficiency programs sponsored by California utilities. Representatives of apartment managers indicated that they were more likely to have participated than owners were. Programs had been used more often in older complexes. Larger operators were more likely to have used programs than smaller ones.

Survey results indicate that about a fourth of the apartment complexes are planning to make changes in the next three years. The most common change that is anticipated is to renovate a complex or replace obsolete features. It is the larger firms that have plans to remodel. This potentially represents a significant opportunity to upgrade the efficiency of existing apartment dwellings.

1.3.5 Tenant Unit Efficiency

Although the focus of this study has been on common areas for apartment complexes, information was also collected regarding decisions that apartment operators might make with respect to their purchasing of appliances for tenant units. More than half of the operators buy appliances through pre-negotiated contracts, with about 40 percent selecting and buying from available stock. The most common source of appliances is a local distributor or wholesaler, followed by a manufacturer or a manufacturers distributor. Reliability is the most important decision criterion to apartment operators in buying appliances for units. It was followed closely by energy costs when the company pays, energy efficiency and ease of maintenance.

1.4 ORGANIZATON OF REPORT

This report on the results of the survey of common areas for apartment complexes is organized as follows:

- The structure of the apartment market is described in Chapter 2. This includes a discussion of large, medium, and small companies that own and/or manage apartment complexes.
- The characteristics of firms that operate in the apartment market are discussed in Chapter 3. The focus of the discussion is on the number of properties and units both nationally and in California and other business lines in which these firms are involved. Apartment complex management characteristics are assessed, focusing on management style and types of on-site staff.
- Common area decision making is analyzed in Chapter 4. This includes an analysis of key decision makers, drivers of common area decision making, market barriers, information sources, and the role of Energy Service Companies in the market.
- Estimates of the amount of energy-using equipment installed in the common areas of apartment complexes and the efficiency levels of such equipment are presented in Chapter 5.
- Common area energy efficiency improvements are assessed in Chapter 6. The assessment covers the types of improvements made, the year improvements were made, reasons for improvement, role of energy efficiency programs, and future plans for improvements.
- Barriers to making energy efficiency improvements for common areas are identified and analyzed in Chapter 7.
- Energy efficiency improvements to individual units are discussed in Chapter 8, focusing on drivers of decision making for individual units and the role of energy efficiency programs.
- A summary of the study and the major conclusions are presented in Chapter 9.
- Appendix A is a description of the methodology used for the study.
- Appendix B contains copies of the data collection instruments.
- Appendix C provides detailed tables showing the amounts and characteristics of energy-using equipment installed in common areas of apartment complexes.

2. OVERVIEW OF APARTMENT MARKET

This chapter provides an overview of the apartment market. The characterization of the market is based on data from in-depth interviews with key decision makers that own and/or manage apartment complexes, from on-site data collection, and from telephone interviews with decision makers at individual apartment complexes.

2.1 CHARACTERISTICS OF APARTMENT COMPLEXES

Data were collected through the on-site survey on various characteristics of apartment complexes. When the survey data are expanded to represent the population of apartment complexes in the combined service areas of PG&E, SCE, SCG, and SDG&E, there are an estimated 28,650 apartment complexes. The distribution of the complexes across service areas is shown in Figure 2-1.

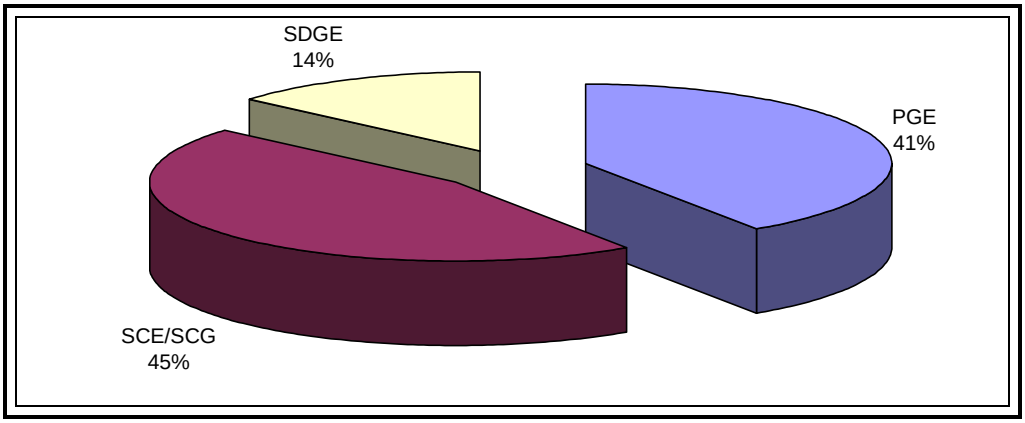

Figure 2-1. Percentage Distribution of Apartment Complexes across Service Areas

Table 2-1 further characterizes the population of apartment complexes according to the number of units in a complex.

Table 2-1. Number of Apartment Complexes by Size of Complex

Units per Apartment Complex	*Combined Service Areas*	*Individual Utility Service Areas*		
		PG&E	*SCE/SCG*	*SDG&E*
All complexes	28,650	11,640	13,120	3,890
100 or fewer	21,320	9,820	8,140	3,360
101 to 250	5,830	1,490	3,920	430
Over 250	1,490	330	1,070	100

Table 2-2 shows the distribution of the complexes according to the year when the complex was built. About 70 percent of the complexes were built in the 1970s and

1980s, while just seven percent were built in the 1990s. The low percentage in the 1990s reflects the "building bust" when the California economy was severely affected by declines in the aerospace and related industries. PG&E and SDG&E's service territories have a greater percentage of complexes built prior to 1970 while SCE's service territory has a greater percentage of units built in the 1980s.

Table 2-2. Number of Apartment Complexes by Service Area and Year Built

Year Built	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
All complexes	28,650	11,640	13,120	3,890
Before 1950	860	550	120	200
1950 through 1959	790	290	370	130
1960 through 1969	4,940	2,100	2,300	540
1970 through 1979	10,400	4,300	4,700	1,400
1980 through 1989	8,820	3,150	4,480	1,190
1990 through 1999	1,690	670	790	230
Year built not known	1,150	590	370	190

2.2 TYPES OF BUILDINGS AND UNITS AT COMPLEXES

Table 2-3 shows the numbers of buildings for apartment complexes classified by size and by service area and the numbers of apartment units for the complexes. While Table 2-1 showed that complexes with 100 or fewer units account for 74 percent of the population of complexes, Table 2-3 shows that they account for 51 percent of apartment units.

For the combined service areas, the data in Table 2-3 indicate that there is an average of 9.5 buildings per apartment complex, with an average of 10.6 apartment units per building. The average number of units per complex is about 100.

Table 2-4 provides data on the types of building structures that are found at apartment complexes. The predominant type of building structure is a one-or-two story building with five or more units.

Table 2-3. Number of Buildings and Apartment Units by Service Area and Size of Apartment Complex

Units per Apartment Complex	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
		Numbers of Buildings		
All complexes	271,490	101,740	145,310	24,440
100 or fewer	155,460	68,080	70,210	17,170
101 to 250	67,300	22,300	40,420	4,580
Over 250	48,740	11,360	34,670	2,700
		Numbers of Apartment Units		
All complexes	2,886,790	998,340	1,585,950	302,510
100 or fewer	1,472,810	637,170	640,400	195,240
101 to 250	865,300	249,850	548,610	66,840
Over 250	548,680	111,310	396,940	40,430

Table 2-4. Apartment Complexes Having Different Types of Building Structures

Type of Building Structure	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
All complexes	28,650	11,640	13,120	3,890
2-4 units, 1 story	7%	7%	7%	7%
2-4 units, 2 stories	10%	16%	6%	3%
5+ units, 1-2 stories	64%	55%	70%	71%
5+ units, 3+ stories	21%	20%	21%	22%
Other	14%	27%	5%	4%

Table 2-5 shows the types of apartment units that are found at the apartment complexes. Several observations can be made.

- Complexes in SCE's service territory tend to have more units than complexes in PG&E and SDG&E's service territories.
- Complexes built in the 1980s tend to have more units per complex, complexes built in the 1970s tend to have a higher percentage of efficiency units, and complexes built in the 1990s tend to have a higher percentage of two bedroom units and a much lower percentage of efficiency units.
- On average, 8 percent of the units at a complex are efficiency units, 41 percent are one bedroom units, 26 percent are two bedroom units, and six percent are three bedroom units. The distribution of types of units is comparable across service territories.

Table 2-5. Number and Types of Units at Complex

	Number of units at complex		Mean percent of units that are:			
	Mean	Median	Efficiency	1 Bedroom	2 Bedroom	3 Bedroom
			Overall			
	100	88	8%	41%	46%	6%
			By Utility Service Territory			
PG&E	85	66	8%	43%	46%	4%
SCE	126	100	7%	40%	47%	6%
SDG&E	78	60	10%	39%	42%	95
			By Year Built			
Pre-1970	93	78	14%	38%	42%	6%
1970s	102	93	8%	41%	44%	8%
1980s	116	96	6%	44%	45%	4%
1990s	94	78	0%	30%	62%	8%

2.3 RENTS

Table 2-6 presents data on average monthly rents for all apartments by service territory. Overall, the lowest and highest average monthly rents are $701 and $1,037, respectively. The rent per square foot for units with the lowest monthly rent is $1.07 compared to $1.03 for units with the highest monthly rents. Although average monthly rents are highest in SCE's service territory ($710 for units with lowest rents and $1,079 for units with highest rents), average rents per square foot are highest in PG&E's service territory ($1.10 for units with lowest rents and $1.07 for units with highest rents).

Table 2-7 presents data on average monthly rents when apartment complexes are classified according to the year built. As expected, average monthly rents and rents per square foot are highest in complexes that were built during the 1990s. Interestingly, the average monthly rents and rents per square foot are higher among complexes built prior to 1970 compared to complexes built in the 1970s and 1980s.

Table 2-6. Mean and Median Monthly Rents: Overall and by Service Area

	Lowest monthly rent	Square feet of unit with lowest monthly rent	Lowest monthly rent per square foot	Highest monthly rent	Square feet of unit with highest monthly rent	Highest monthly rent per square foot
			Overall			
Mean	$701	685	$1.07	$1,037	1,000	$1.03
Median	$650	675	$0.99	$845	975	$0.89
			PG&E Service Area			
Mean	$705	682	$1.10	$1,057	993	$1.07
Median	$575	675	$0.89	$739	950	$0.82
			SCE/SCG Service Area			
Mean	$710	679	$1.07	$1,079	1,022	$1.04
Median	$725	675	$1.05	$950	1,000	$0.96
			SDG&E Service Area			
Mean	$665	711	$1.01	$867	963	$0.92
Median	$650	685	$0.93	$850	945	$0.89

Table 2-7. Mean and Median Monthly Rents: Overall and by Year Complex Was Built

	Lowest monthly rent	Square feet of unit with lowest monthly rent	Lowest monthly rent per square foot	Highest monthly rent	Square feet of unit with highest monthly rent	Highest monthly rent per square foot
			Overall			
Mean	$701	685	$1.07	$1,037	1,000	$1.03
Median	$650	675	$0.99	$845	975	$0.89
			Pre-1970			
Mean	$753	669	$1.23	$1,217	1,030	$1.25
Median	$725	648	$1.08	$1,025	1,000	$0.98
			1970s			
Mean	$693	710	$1.02	$966	1,019	$0.96
Median	$715	700	$0.98	$895	1,000	$0.90
			1980s			
Mean	$634	653	$1.00	$871	935	$0.92
Median	$625	650	$0.89	$780	900	$0.85
			1990s			
Mean	$953	765	$1.25	$1,678	1,090	$1.40
Median	$775	728	$0.98	$925	1,028	$0.89

Comparisons of the average monthly rents for controlled and uncontrolled complexes are presented in Table 2-8. Rents are controlled in 19 percent of the complexes. The majority of complexes with controlled or regulated rents provide subsidized affordable/low-income housing sponsored by local/federal government agencies. As expected, the average monthly rents are lower for units in complexes having controlled or regulated rents. However, average rent per square foot for units with the highest rents are higher for controlled complexes than uncontrolled complexes ($1.14 and $1.01, respectively). We thought that this might be a result of controlled units being more likely to have commonly metered utilities so that the rents would be higher. However, the evidence to support this hypothesis is mixed. The units with the lowest cost per square did have a higher per square foot cost in controlled than uncontrolled complexes. However, just the opposite was true for the most costly units in controlled complexes.

Table 2-8. Average Monthly Rents for Controlled and Uncontrolled Complexes

	Lowest monthly rent	*Square feet of unit with lowest monthly rent*	*Lowest monthly rent per square foot*	*Highest monthly rent*	*Square feet of unit with highest monthly rent*	*Highest monthly rent per square foot*
			Controlled			
Mean	$655	672	$1.01	$999	913	$1.14
Median	$600	660	$0.96	$834	950	$0.98
			Uncontrolled			
Mean	$701	684	$1.08	$1,034	1,013	$1.01
Median	$650	675	$0.99	$850	996	$0.89

3. OWNERSHIP AND MANAGEMENT OF APARTMENT COMPLEXES

This chapter presents and discusses information on the characteristics of apartment operators in California. The term *operators* is used generically to describe firms that both own and manage their own properties and firms that manage properties only. In reality, most firms do some of both although some firms mostly own and manage while others mostly manage. There are times when we will make the distinction between owning and managing and managing as to better understand the target audience. We also use *firm*, unless otherwise noted, to refer to both groups. In later sections, we will use some of these organizational characteristics to help understand the market, the market audiences, and how they make decisions.

We also need to be clear about some of the other terminology that we use. We tend to use the words *complex or complexes* and *property or properties* interchangeably. The words *unit* and *apartment* are also used interchangeably. Thus, we may speak of a complex or property as having 35 units or apartments. *Buildings* may have one or many units.

The reader also needs to know that the results that are presented are weighted so that they reflect apartments and apartment operators in California. Tables will either show the total number of units in California or some subset of them or they will show weighted percentages that reflect the presence of the characteristic in the California population. The weighting is based on the size of the complex where there was an inventory of energy using equipment in California.

3.1 NUMBER OF PROPERTIES AND UNITS OWNED

Estimates were prepared on the numbers of properties and units that an operator owns both nationally and in California.

3.1.1 Number of Properties and Units Owned Nationally

Nationally on average, operators deal with 106 properties and 5,465 units resulting in an average of 114 units per property. The average is skewed by larger firms, as is demonstrated by the fact that the median number of properties and units is 13 and 800, respectively. There are some large operators who have a substantial share of the market. The distribution of properties, units, and units per property are presented in Table 3-1, Table 3-2, and Table 3-3.

Table 3-1. Number of Properties Nationally

Number of properties		Percent of properties owned by firms that have:			
Mean	Median	1-4 properties	5-14 properties	15-49 properties	50+ properties
106	13	33%	18%	27%	23%

Table 3-2. Number of Units Nationally

Number of units		Percent of firms that have:			
Mean	Median	1-249 units	250-999 units	1,000-4,999 units	5,000+ units
5,465	800	33%	22%	30%	16%

Table 3-3. Units per Property Nationally

Number of units per property		Percent of complexes that have:			
Mean	Median	1-49 units per property	50-99 units per property	100-199 units per property	200+ units per property
114	69	37%	23%	26%	14%

3.1.2 Units Owned in California

For the most part, the companies operate in California. On average, 91 percent of units that a firm owns are located in California. Eighty-six percent of the firms have 100 percent of their units in California. The remaining firms are distributed as shown in Table 3-4.

Table 3-4. Percent of Units in California

Mean percent of units in CA	Percent of complexes owned by firms that have:			
	1-24 percent of units in CA	25-49 percent of units in CA	50-99 percent of units in CA	100 percent of units in CA
91%	8%	2%	4%	86%

3.1.3 Other business lines

Forty-one percent of firms have business lines in addition to owning and managing multi-family properties. The vast majority of these are related to commercial real estate.

3.2 ORGANIZATIONAL STRUCTURES FOR APARTMENT COMPLEX OPERATORS

Information about the organizational structure of various entities in the apartment market was gathered through on-site interviews and telephone interviews. This information is the basis for the following discussion of large, medium, and small companies that own and/or manage apartment complexes.

Players in the California apartment market vary in a number of key dimensions. Players vary with respect to size, ranging from owners who may have a duplex or a few apartments to large international corporations that own 20,000 or more units in California and large numbers of other units elsewhere in the US and the world. Another dimension along which the market can be divided is the degree to which companies exclusively own and manage their own units or mostly manage the complexes for owners and other companies. Yet another dimension is the degree to which companies are actively developing real estate either through new buildings or purchasing and renovating existing buildings.

3.2.1 Large Companies

We can start with multifamily units. About a quarter of all multifamily units are owned or managed by companies that deal with 5,000 or more units and 50 or more complexes. For analytic purposes, we identify these as large companies. The very largest companies can own and manage up to 200,000 units or more. There are several firms in the 15,000 to 80,000 unit range. In this group of large companies, firms that own or manage closer to 5,000 units may look and act more like medium-size firms.

3.2.1.1 Overall Organizational Structure for Large Companies

For large companies, the overall organizational structure can be very complex, as shown by Figure 3-1. At the pinnacle of the structure is the owner or the owners who play an active role in the company or a president or CEO representing the investors. There is usually a group of senior managers, with titles such as Vice President, who are responsible for financial management, development, operations, planning, purchasing, and acquisitions.

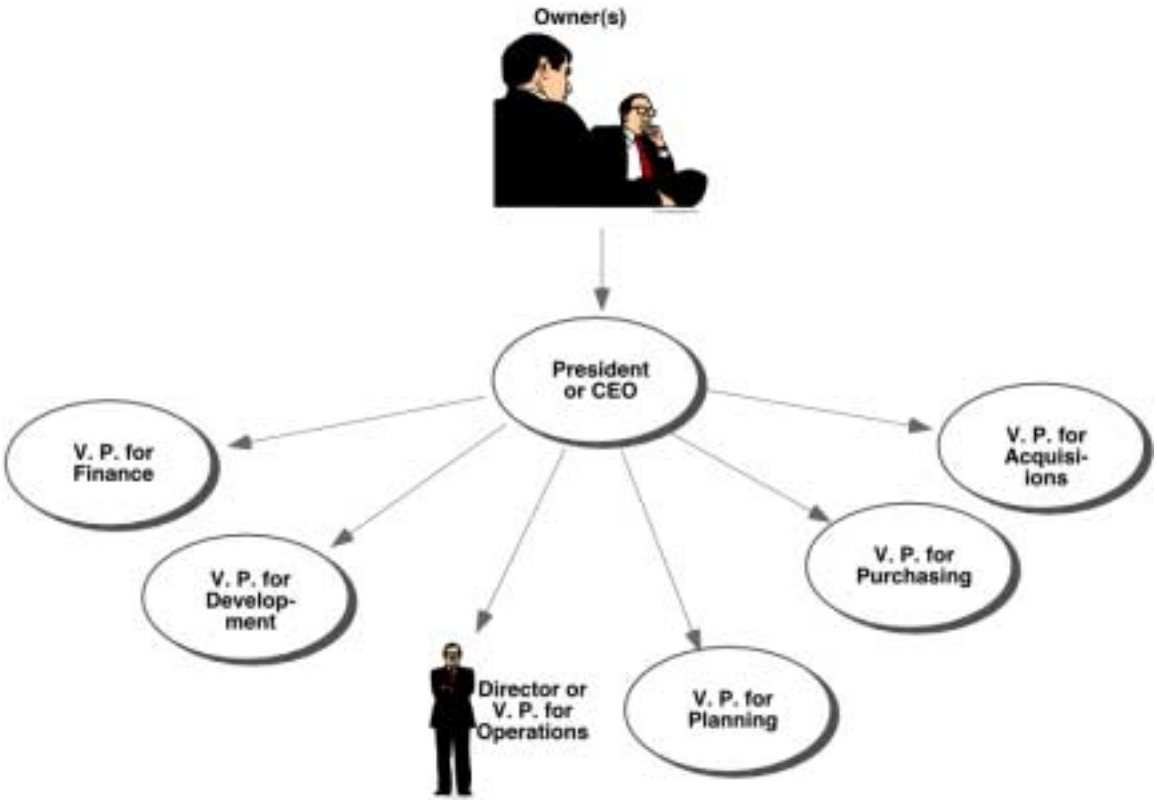

Figure 3-1. Organizational Structure for a Large Company Owning or Managing Apartment Complexes

Although the titles and the exact division of responsibilities vary from company to company, the generic responsibilities in a large company are as follows.

- Typically, financial managers are responsible for obtaining and managing capital, managing cash flows, and establishing investment criteria.
- The property development group is responsible for developing new properties or renovating older properties.
- The operations group is responsible for managing properties once they are available for tenancy.
- The planning manager is typically responsible for developing the long-range plans for the company and for making decisions about the types and location of future investments as well as the disposition of current investments.
- A purchasing manager is responsible for purchasing or contracting for materials and services.
- The property acquisition group is responsible for identifying property and managing the acquisition or sale of property.

3.2.1.2 Structure of Property Operations

In terms of the decisions that influence the choice of equipment and design of apartment complexes, we will primarily focus on operations and development. The structure for operations is usually similar to the one in Figure 3-2. Several people, including a senior property manager and a senior maintenance supervisor will report to the Director or Vice President for Operations. If the company has properties in different parts of the country, and in the case of California in the north and the south, then there is likely to be a regional manager responsible for the properties in a given area. Beneath the regional property manager there is likely to be several property supervisors. The property supervisor is usually responsible for between 5 and 15 properties depending on the size and staffing at the properties. The property supervisor provides general oversight, helps to establish budgets for a property and is responsible for staffing the management side of the property operation.

The senior maintenance supervisor, who generally reports to the Vice President for Operations, is responsible for maintenance at company properties. This person is likely to have an engineering degree and perhaps may have staff with such degrees. Alternatively, this person may have extensive experience. This person is responsible for overall maintenance policy management. This person or a regional maintenance manager would be directly involved in discussions about renovations and remodeling for particular complexes.

If the properties are numerous and large, there are usually regional maintenance supervisors. They are responsible for maintenance budgets, evaluating large maintenance investments, and hiring and managing on-site maintenance supervisors. Such regional managers or their subordinates may also supervise roving maintenance staff. Included among these may be personnel who deal with specialized equipment like HVAC systems.

Staffing at the sites is a function of the number of units. Large complexes will have a property or leasing manager, and one or more leasing associates. As a rule of thumb, there is usually a property or leasing manager / associate for every 80–100 units. The large companies tend to have large complexes with 250 or more units. In conjunction with the property supervisor, the property or leasing manager is responsible for hiring leasing associates. The property or leasing manager/associate usually has four basic responsibilities: general oversight of the property, leasing units, collecting lease payments, and managing tenant relations. In the largest complexes the property or leasing manager may have substantial authority to deal with issues.

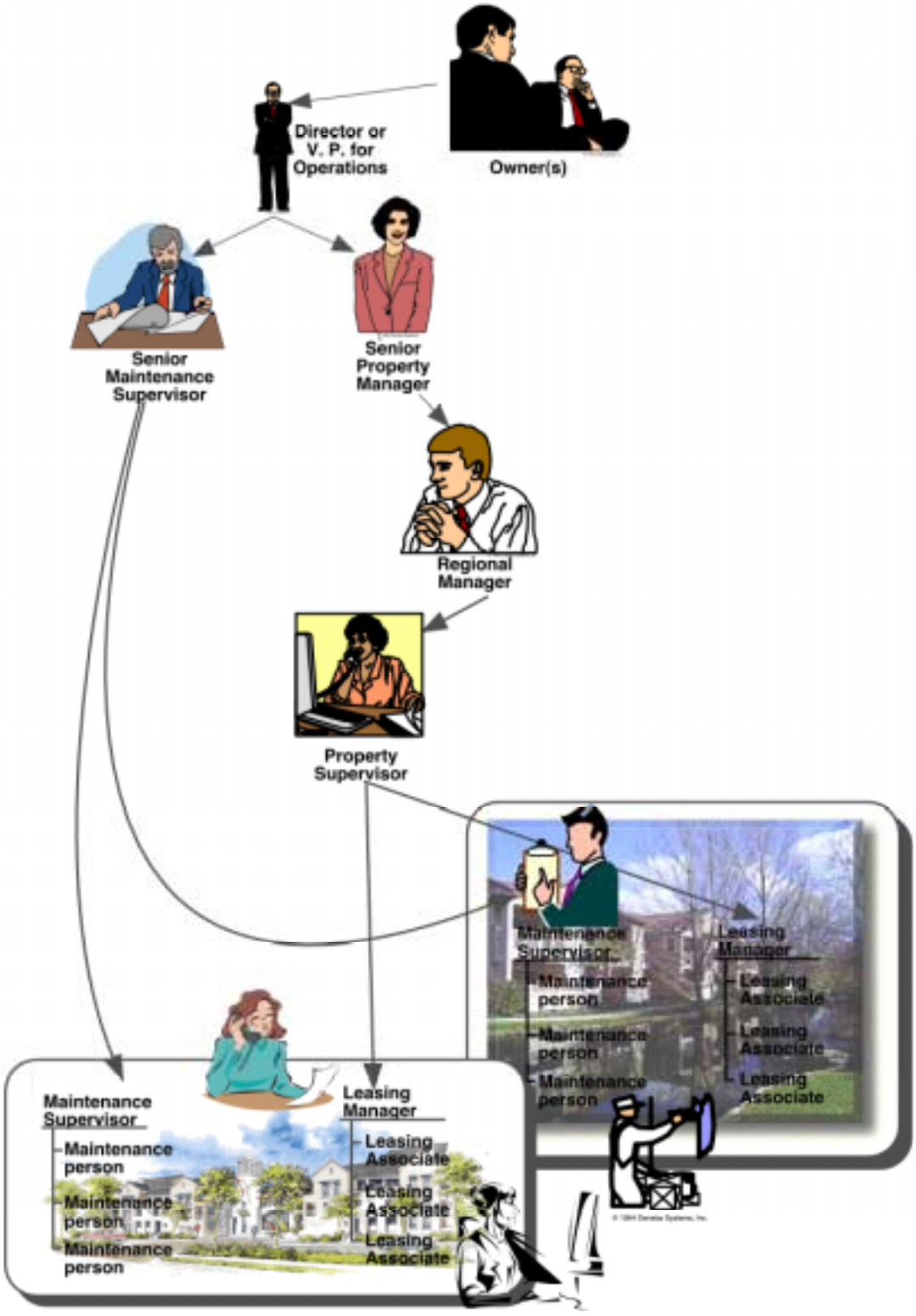

Figure 3-2. Structure of Property Operations in Large Companies

In large complexes the maintenance supervisor usually coordinates with the leasing manager but reports to a different person within the company chain. The leasing manager may receive maintenance complaints but will then refer them to the maintenance supervisor. In addition to the maintenance supervisor, there may be from one to several maintenance personnel. The skill levels of these individuals can vary greatly. Some of the largest complexes may have full-time landscape personnel and painters to speed the turn around of vacant apartments.

Maintenance supervisors are responsible for maintaining the property according to company standards. It is unlikely that a maintenance supervisor will have a college degree except at the larger sites. They take general care of building systems and usually have sufficient skills to take care of most basic carpentry, electrical and plumbing problems, although this too will vary with the size of the site.

Managers for some of the medium-size companies told us that the skill level of their general maintenance personnel does not extend beyond simple change outs. Changing a ballast may be beyond the skill level of the general maintenance person. One of the barriers that they cited in making equipment choices was that personnel were not able to maintain lighting equipment that involved properly connecting ballasts. At the other end of the scale, some sites have personnel who can maintain and repair refrigeration equipment.

3.2.2 Medium Companies

As defined for purposes of this study, medium-size companies typically own or manage between 250 and 5,000 units. Many of these companies are "family" operations that have grown over the years. In other instances, they may be a group of property owners whose property is managed for them by the management company. A management company may own a few properties on its own and manage properties for others. In the one-to-one interviews, those who owned or managed units in this range said that the units they were managing were being managed for friends. There are management companies that only manage properties but they are not many in number. The major difference between a large and medium-size company is that the structure gets squeezed at the bottom and the top.

Figure 3-3 illustrates a structure that might be typical of a medium-size company. Owners are the key players with respect to acquisition and retention of properties. They play an important role in setting policy. They may be more or less involved in day-to-day management of properties depending on the size of the firm. As the number of units drops below 1,000, owners may have a broader range of responsibilities and more day-to-day oversight of properties.

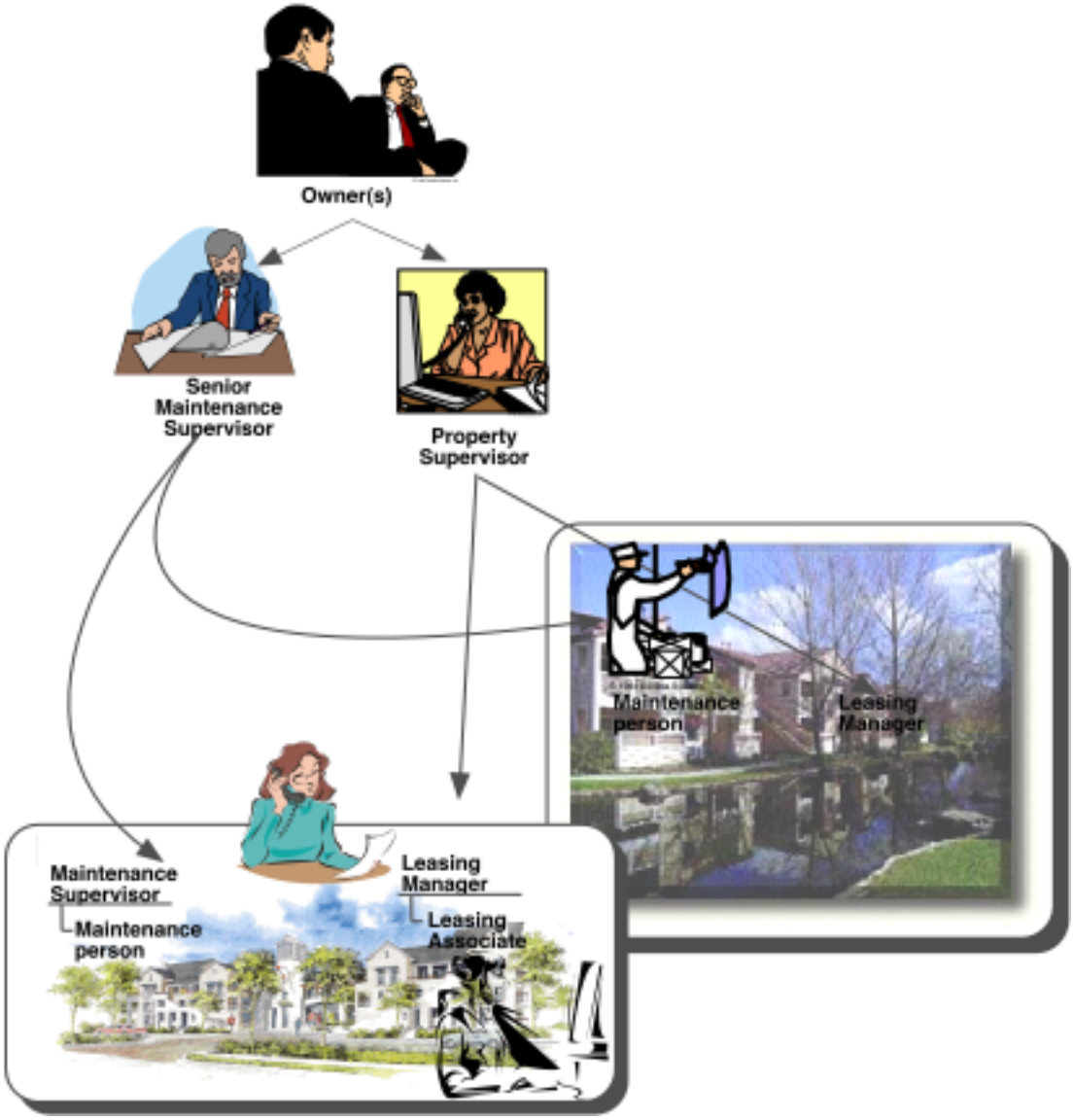

Figure 3-3. Typical Structure of a Medium-Sized Multifamily Firm

A medium-size firm will typically have from one to several property supervisors. Depending on the size of the properties, the supervisor will manage from three to 15 properties. Those who manage more properties will usually have several small properties with just a few units and then three to five larger properties with many units.

The senior property manager is responsible for staffing the properties, approving the decisions of staff, monitoring the vacancy rate, monitoring the physical status of the property, monitoring and reporting the financial status of the property either to superiors or to the owners. Senior property managers work with the owners to plan maintenance and upgrades to equipment. In many instances, senior property managers are the ultimate authority on decisions about equipment replacements and changes to the property.

The number and sophistication of maintenance personnel will depend on the number of units in a complex. Larger complexes will have maintenance staff. Smaller properties may have a part-time individual who receives reduced rent or a unit free for handling minor maintenance problems. A roving maintenance team also may service small properties. On-site personnel or roving personnel will recommend equipment replacements but the approval of such replacements is generally the responsibility of the senior property manager.

For replacement of appliances and equipment, the senior property manager will approve the decision and inform the owner. This may be done through the vehicle of a monthly financial report or if the requirement is large and somewhat unexpected through a courtesy call or conversation with the owner. If there is to be a major change and a major expense, then the senior manager will work with the owner to develop a plan and then the senior property manager and / or other senior staff will execute the plan. The goal is to make sure that the owner understands what is happening with respect to cash flow and income from the property.

Choices about the type of equipment such as appliances are often limited by pre-negotiated contracts or purchase agreements. Senior property managers may play a role in working out such agreements in concert with a purchasing / financial manager and / or the owner. When more extensive products and services are needed, for example architectural services, the senior property manager may obtain services from a house contractor or request bids for such services working in concert with the owners and other senior personnel.

Staffing at the property level greatly depends on the size of the property. Larger properties will have a manager or leasing manager and a maintenance person. The manager is responsible for keeping the properties leased, dealing with tenant relation problems, collecting rent, and monitoring what is physically happening with the property. Management of small properties with just a few units may be handled directly by someone in the company office. Someone who lives at the property and who receives reduced rents may handle showing the property.

3.2.3 Small Companies

For this report we define small companies as those having fewer than 1,000 units in one or more buildings and complexes. Operators at this level either contract with a management firm or manage the units on their own. This discussion of small firms focuses mostly on firms that manage the units on their own. Those who contract management are likely to use a medium-size management company.

The smallest firms usually have properties with relatively small numbers of units. For small firms with more and larger units, the organizational form begins to approximate that of the medium-size companies described previously.

Once the number of units gets below 250 units, the owner does most of the management and decision making. For the complexes with more than a few units, the owner may have a tenant who serves as an on-site manager who is compensated with a reduced or rent free apartment. If the complex is large enough, there may be a full-time manager. Otherwise, tenant relations may be handled directly from the owner's office.

Owners may handle their own maintenance or if they have enough maintenance work they may have one or two maintenance persons who rove among complexes. In some instances, a tenant may receive compensation for handling light maintenance. For most maintenance, the owner will either do the maintenance directly or hire a contractor to do it as needed.

What this means is that for the smallest firms, the owner is the primary decision maker. That person may rely on a maintenance person to help with certain decisions. In the smallest firms, if appliances need to be replaced the owner will go to a local distributor or retail outlet to obtain what is needed. More extensive changes and maintenance are handled through a contractor or in some cases by the owner. A number of the small property owners are contractors, architects or engineers who are in a position to manage maintenance issues.

3.3 MANAGEMENT PRACTICES

Apartment complexes vary with respect to how they are managed and staffed. This section briefly describes what we have learned about how complexes are managed and staffed.

3.3.1 Management Style

Slightly more apartment complexes are managed by the company that owns the complex than are managed by a company contracted to provide management services. Fifty-two percent of complexes are managed by the company that owns the property while 48 percent are managed by a different company. As we shall see below, this difference has significant bearing on how decisions about efficient equipment are made.

3.3.2 On-site staff

The number of on-site staff in apartment complexes range from 1 to 25 employees with a mean of 3.2 per complex. The staff at the average site consists of a facility manager, a maintenance person and in some cases a maintenance supervisor or engineer. Roughly one in five complexes have an on-site leasing manager. Table 3-5 presents results from

the survey pertaining to the number and type of on-site staff located at California apartment complexes.

Table 3-5. On-site Staff per Complex

	Total	*Facility managers*	*Maintenance staff*	*Maintenance supervisors or facility engineers*	*Leasing managers*
Range	1-25	0-4	0-8	0-4	0-2
Mean	3.2	1.3	0.9	0.6	0.2
Mode	2	1	1	0	0

4. DECISION MAKING PRACTICES FOR COMMON AREAS

This chapter extends the discussion from Chapter 3 to describe the decision making practices pertaining to common areas of apartment complexes. Key decision makers are identified, the sources of information and the role of energy service providers are discussed, and factors affecting decision making for common areas are assessed.

4.1 KEY DECISION MAKERS

Who makes the key decisions about equipment in common areas of apartment complexes depends on the characteristics of the owning or managing organization, such as the size of the organizations and the characteristics of the complex. As Table 4-1 shows, the most frequently mentioned decision maker (40 percent of complexes) is the site manager. The next most frequently mentioned key decision makers are owners, senior or multi-site managers, and maintenance supervisors followed by maintenance staff. The category *others* is mostly senior managers of firms and probably should be included with owners in an owner/managers category. If these two categories are combined, the most frequent key decision makers are then the owners and senior managers.

Table 4-1. Key Decision Makers for Common Area Equipment

Decision maker	*Percent of complexes*[1]
Site or complex manager	40%
Owner	33%
Senior housing manager	17%
Maintenance supervisor	16%
Maintenance staff	5%
Senior off-site managers	7%

[1]Percentages can add to more than 100 because respondents were allowed to make more than one choice.

The picture changes somewhat when we examine who the key decision makers are by the characteristics of the firm owning or managing the complex. Table 4-2 shows key decision makers when firms are categorized by number of properties owned or managed. The site or complex manager is more likely to be a decision maker for firms with the fewest properties. Senior housing managers and senior off-site managers are most active for firms with the largest number of properties while owners are most active when the number of properties is small.

Table 4-2. Key Decision Makers by Number of Corporate Properties Owned or Managed by Apartment Complex Operator (Percent of Complexes)

Decision maker	Number of Properties			
	1-4	5-14	15-49	50+
Maintenance staff	2%	8%	3%	1%
Maintenance supervisor	14%	19%	10%	20%
Site or complex manager	48%	37%	36%	42%
Senior housing manager	2%	16%	27%	32%
Owner	46%	43%	28%	18%
Senior off-site managers	<1	3%	5%	18%

[1] The base of the percent is the column. Percentages can add to more than 100 because respondents were allowed to make more than one choice.

When we examine who the key decision makers are by number of units in the complex in which the equipment inventory was done, we see a similar pattern. Table 4-3 shows that site managers are most often the key decision makers in all but the largest complexes. Owners are most often a key decision maker in all but the largest complexes. The senior housing and senior off-site managers are most often the key decision makers in the larger units. Maintenance supervisors tend to be key decision makers in the largest complexes.

Table 4-3. Key Decision Makers by Number of Units at Target Property (Percent of Complexes)

Decision maker	Number of Units in Complex			
	1-79	80-119	120-249	250+
Maintenance staff	6%	4%	7%	3%
Maintenance supervisor	14%	15%	21%	28%
Site or complex manager	41%	41%	40%	21%
Senior housing manager	15%	18%	13%	32%
Owner	33%	34%	32%	24%
Senior off-site managers	4%	7%	17%	7%

[1] The base of the percent is the column. Percentages can add to more than 100 because respondents were allowed to make more than one choice.

When we look at key decision makers in terms of the size of the corporation owning or managing the apartments, once again we see that owners are likely to be the key decision makers for the smaller companies. These data are shown in Table 4-4. Senior housing and other managers are likely to be the key decision makers for the largest companies. Maintenance supervisors are also most often the key decision makers for the largest corporations. The site or complex manager is a key decision maker for the smallest and largest firms.

Table 4-4. Key Decision Makers by Number of Units Owned or Managed Nationwide (Percent of Complexes)

Decision maker	Number of Units Nationwide			
	1-249	250-999	1,000-4,999	5,000+
Maintenance staff	5%	<1%	4%	<1%
Maintenance supervisor	10%	20%	7%	32%
Site or complex manager	41%	36%	34%	50%
Senior housing manager	2%	16%	32%	35%
Owner	53%	38%	25%	22%
Senior off-site manager	0%	6%	13%	8%

[1] The base of the percent is the column. Percentages can add to more than 100 because respondents were allowed to make more than one choice.

We can also examine who the decision makers are by whether the company typically owns and manages its own properties or whether it is a management firm. When we do this, Table 4-5 shows that we find that there are three key differences. Owners are more likely to be involved in decision making when it is their property rather than when the property is being managed. Senior housing managers are more likely to be key decision makers for managed properties. Finally, senior off-site managers are more likely to be involved in ownership situations. Site managers typically are more involved at smaller sites with fewer properties.

Table 4-5. Key Decision Makers by Whether Company Owns and Manages or Just Manages Complexes (Percent of Complexes)

Decision maker	Owns and manages	Manages but does not own
Site manager	38%	43%
Owner	42%	23%
Senior housing manager	7%	27%
Maintenance supervisor	18%	15%
Maintenance staff	5%	5%
Others	10%	3%

[1] The base of the percent is the column. Percentages can add to more than 100 because respondents were allowed to make more than one choice.

From a programmatic perspective, site managers and owners are the primary targets with senior housing managers and maintenance supervisors also being important. For small companies that own properties with few and small complexes, owners should be the key target. For large management corporations with large sites and many complexes, the target should be senior housing managers. For corporations that own and manage large sites and large numbers of complexes, the target should be senior off-site managers. Site

managers are frequent targets but should especially be targeted when they represent a firm with smaller and fewer complexes.

4.2 SOURCES OF INFORMATION FOR MARKET ACTORS

The sources of information that market actors use to support their routine common area equipment decisions are shown in Table 4-6. Key sources are contractors and internal maintenance staff. Distributors and manufacturers are less often used as sources of information. Trade publications and utility companies are cited as sources least often.

Table 4-6. Sources of Information

Information source	*Percent of complexes citing*
Contractors	55%
Internal maintenance staff	41%
Distributors	27%
Manufacturers	23%
Dealers	18%
Trade publications	9%
Utilities	8%

Reliance upon local contractors and internal maintenance staff is probably indicative of decision makers' low levels of interest in information about equipment. Several people we talked with during the in-depth interviews indicated that they have little interest in and spend little time at equipment related information search activities. Many of the same people said that they did not use trade publications, and this is borne out by the low percentage of persons indicating that trade publications are a source of information. When we looked at apartment association web-sites we found very little information about equipment and equipment selection.

In the in-depth interviews, people also reported that they had little direct interaction with utilities. The low percentage of persons reporting utilities as a source of information for decisions about common area equipment is indicative of this. As we shall see later in this report, only a small percentage of market actors in the apartment sector have taken part in utility programs, and many probably do not think of utility companies as an information source when it comes to replacing equipment in common areas. During the in-depth interviews several people indicated an interest in having utilities be more proactive.

From a programmatic perspective it is clear that utilities could play a role in providing information. However, if they are to do so in an effective way, they will have to do at least three things.

- First, the utilities will have to become a recognized player in this area. One possibility is to partner with apartment owner associations although these groups appear to be focused on policy issues and they reach only a portion of all apartment owners.
- Secondly, information activities need to be structured to reach key decisions makers with appropriate types of information. The earlier sections on who the decision makers are point to the diversity of market actors involved in decision making. A range of different information activities and content is required to reach these audiences.
- Third, the data from the in-depth interviews and our broad reading of the survey data suggest that search activities for building and equipment information is not a highly valued activity among market actors. Information related activities will need to be carefully structured to provide information in a timely, salient and usable way.

4.3 ROLE OF ENERGY SERVICE COMPANIES

In the newly competitive environment, third parties can approach customers to offer products and services and obtain their energy business. This is happening in all sectors in California. We asked the respondents in our surveys whether or not they had been approached by third party energy providers.

Third party providers offered energy efficiency products or services to 13 percent of the respondents in our California sample. Thus, a large part (87 percent) of the apartment market in California has not been approached. Among the 13 percent of respondents who have been offered services by third party providers, 44 percent (six percent of the population) accepted the offer. For the 56 percent not accepting the offer, the most common reason for not accepting the offer was that the claimed level of energy savings was perceived to be too optimistic. Twenty-seven percent did not believe the savings estimate (see Table 4-7). The next most important reason was that people did not want to lease equipment.

Table 4-7. Reasons for Not Accepting a Third Party Offer

Reason for not accepting ESCO offer	*Percent of complexes citing*
Did not believe the savings or offering	27%
Did not want to lease equipment	13%
Equipment was not appropriate for facility	10%
No interest in changing things	8%
Savings were not enough to justify cost	6%
No time to consider this	5%
Offering too expensive	1%
Don't know	29%

For the 44 percent accepting the third party offer, low-flow showerheads (22 percent) and insulation or weather-stripping measures (22 percent) were the most commonly accepted products and services (see Table 4-8). Since hot water equipment and energy saving measures are currently accepted at a relatively low rate (8 percent) and such measures would save both water and energy resources, this can be a target area for market transformation efforts.

Table 4-8. Action Taken with Third Party Provider

Action taken	*Percent of complexes*
Low-flow shower heads	22%
Insulation / weatherization	22%
Lighting upgrade	10%
Hot water heating equipment measures	8%
Water saving toilets	8%
Don't know	15%

Third party offerings were almost twice as successful when presented to representatives of owner operated complexes (58 percent) than when presented to contract operated ones (30 percent). The likely explanation is that owner operators are approached directly and make the decision while contract operators accept the proposal from the third party and then present and defend a recommendation with the owner. Contract operators may screen owners from proposals depending on how they think the owners will react. They may summarize the proposal for the owners. They may also be less effective in presenting the proposal than would the third party vendor.

These data suggest that third party energy service providers have not extensively targeted apartment operators. To the extent they have targeted apartment operators they have not been successful in selling energy efficiency products and services. This is not surprising. Common area loads are not typically large and the tenant loads, especially the electric loads, are almost always individual accounts. Unless the apartment management can deliver the "residence" load, the units must be dealt with individually and they may be more difficult to reach and maintain than an owned residential unit because of the transient nature of the population. Apartment operators often do maintain accounts during a vacancy period so that a third party provider might find some advantage in dealing with apartment operators. However, it is not clear what incentives might be offered.

As a final word of caution, we should note that care should be exercised in interpreting the third party provider data because of the small number of respondents represented in the data.

4.4 DRIVERS OF COMMON AREA DECISION MAKING

Apartment operators were asked in the telephone survey about the decision criteria that drive their selection of common area equipment. The ratings are summarized in Table 4-9. As rated by respondents on a 10-point scale, equipment reliability is the most important criteria for determining what major replacement equipment (boilers and HVAC equipment as well as lighting systems) is selected for common areas in California apartment complexes. Ease of maintenance, energy costs for the apartment owner, and energy efficiency are close behind in these decisions. Further down the importance scale are issues such as the purchase price or first cost of the equipment, past experience with the equipment and following company purchasing guidelines. The criterion, judged least important overall, is replacing equipment with the same equipment.

Table 4-9. Importance of Equipment Selection Criteria for Common Areas

Equipment selection criteria	*Mean rating*[1]
Reliability of new equipment	9.5
Energy costs of equipment when our company pays energy costs	9.2
Energy efficiency of the new equipment	9.1
Ease of maintenance	9.0
Energy costs when the tenant pays the energy costs	8.4
First cost or purchase price	8.1
Past experience with the equipment	7.9
Company purchase guidelines or procedures	7.8
Replace with identical equipment	6.5

[1] Based on a 1 - 10 scale where one means not at all important and ten means very important

Over the last several years we have completed numerous studies in the commercial sector. All of these studies have found that reliability is the first or second most important criterion in equipment decision making. The reason for this is that the cost of servicing, maintaining, and replacing equipment often exceeds the cost of purchasing the equipment. This is important from a program design perspective. It means that programs need to focus more on the reliability issue. Programs need to avoid recommending equipment and technologies with low reliability. It also suggests that programs should collect and disseminate information about equipment reliability.

In order to get a better idea of the importance of each of these criteria and their relationship to each other, we factor analyzed these nine importance statements. Factor analysis helps to reduce many variables to a few factors or components by identifying which variables are similar to other variables. In this case, we are assessing which criteria are like other criteria (i.e., factors) and how many groupings of criteria exist. Once we have identified the factors we can see how closely each of the variables related to each of the factors. By considering which of the importance criteria are closely associated with each specific factor, we can then identify a pattern and determine an appropriate label for the pattern.

The factor analysis resulted in a three-factor solution; that is, the nine variables can be reduced to three. The first factor explains 32 percent of the variance, the second explains 15 percent and the third, explains 12 percent of the variance. Table 4-10 shows the factor loadings on each of the three factors.

The first factor is an energy cost and efficiency factor although all other variables, except *replacing with an identical model*, load somewhat on this factor. The second factor captures the fact that some people will habitually replace equipment with nearly identical equipment. *Energy cost* also loads somewhat negatively on this factor suggesting that energy cost is not important when people are replacing equipment with the equivalent model. We can call this factor the identical equipment factor. We will call the last factor the cost and experience factor. *First cost* and *prior experience* load strongly positively on this factor while *reliability* and *maintenance* load strongly negatively. People with high scores on this factor are sensitive to equipment costs and reliability and insensitive to ease of maintenance and reliability.

Table 4-10. Factor Loadings for Apartment Operator Equipment Selection Criteria

Equipment selection criteria	*Energy cost and efficiency*	*One-for-one replacement*	*First cost and prior experience*
Replacing equipment with an identical or nearly identical model	0.163	0.741	0.029
Purchasing using company guidelines	0.497	0.348	-0.092
Price or first cost	0.483	0.242	0.538
Prior experience with the equipment	0.444	0.295	0.529
Reliability	0.460	0.245	-0.557
Ease of maintenance	0.633	0.200	-0.436
Energy efficiency	0.699	-0.345	-0.010
Energy cost when the company pays for the utility	0.714	-0.467	0.119
Energy cost when the tenant pays the utility cost	0.753	-0.274	0.0003

We used the factor analysis routine to create factor scores. That is, for each case in the sample, we created a new variable to reflect each of the factors. These variables are standardized and have a mean of zero and a standard deviation of one. Using these variables we can then examine the relationship between these and other variables.

We start by comparing the average scores on the decision factors for the persons identified as the key decision maker. These comparisons are shown in Table 4-11. Average scores vary from one to negative one with a score of zero being the average for the total population. Maintenance staff score very low (-0.74) on the energy cost and efficiency factor and quite high on the one-for-one replacement factor. This makes sense

in terms of their jobs, which are easiest when they can simply reproduce what is already in the common area. Maintenance supervisors score high on the energy cost and efficiency factor as well as the one-to-one replacement factor and also have slightly more interest than average in first cost and prior experience. This also makes sense because they may have responsibilities for approving utility bills, making sure that work gets done, and keeping costs in check. Senior housing managers are perceived to be more sensitive to first cost and less sensitive to one-for-one replacement. Owners are more attuned to energy cost and efficiency and less attuned to first cost. Finally, other senior managers are perceived to have less interest in energy and cost efficiency and first cost than other types of decision makers. These findings are certainly consistent with the findings from the in-depth interviews.

Table 4-11. Average Common Area Decision Factor Scores for Key Decision Makers

Decision maker	*Energy cost and efficiency*	*One-for-one replacement*	*First cost and prior experience*
Maintenance staff	-0.74	0.56	0.06
Maintenance supervisors	0.30	0.25	0.15
Site manager	0.02	-0.08	0.01
Senior housing manager	-0.05	-0.19	0.11
Owner	0.11	-0.07	-0.13
Other manager	-0.19	-0.01	-0.14

We also examined the importance attached to the various criteria by other key organizational variables, such as whether the company owns and manages units or just manages units, the number of units on the property that was inventoried, the number of properties owned or managed, and the number of units owned or managed company-wide.

As shown in Table 4-12, companies that own and manage attach slightly more importance to energy cost and efficiency than do those who just manage properties. Those who just manage properties are less concerned with one-for-one replacement than those who own. Those who just manage have a slight preference for price and prior experience over ease of maintenance and reliability than do those who own and manage.

Table 4-12. Average Common Area Decision Factor Scores by Whether Firm Owns and Manages or Just Manages Units

Management style	*Energy cost and efficiency*	*One-for-one replacement*	*First cost and prior experience*
Owns and manages	0.04	0.04	-0.08
Manages but does not own	-0.04	-0.16	0.06

Next, we examine the relationship of the factors to the number of units in the complex. These results are shown in Table 4-13. Note that the average scores for the first two factors increase with the size of the complex and that the scores of the last factor decrease with size. The implication of this finding is that energy cost and efficiency are more important criteria in larger complexes than smaller complexes. The same is true of one-for-one replacement. This latter finding would be consistent with the need for standardization in larger complexes to keep costs in check. The data also suggest that the smallest complexes, when compared to the larger complexes, are more likely to be concerned with first cost and prior experience.

Table 4-13. Average Common Area Decision Factor Scores by Number of Units in Complex

Number of units in complex	*Energy cost and efficiency*	*One-for-one replacement*	*First cost and prior experience*
1-79	-0.11	-0.07	0.06
80-119	0.01	-0.03	-0.11
120-249	0.07	0.02	-0.02
250+	0.35	0.05	-0.02

When we look at the application of decision criteria by the number of properties that are owned or managed, there is no clear pattern with respect to energy cost and efficiency. These results are shown in Table 4-14. Companies with 5 to 14 properties appear to be the most concerned with energy cost and efficiency. However, a clear pattern emerges with respect to one-for-one replacement and first cost/prior experience. First cost is most important for firms with smaller numbers of properties while one-for-one replacement is just the opposite.

Table 4-14. Average Common Area Decision Factor Scores by Number of Properties Owned or Managed by Firm

Number of properties	*Energy cost and efficiency*	*One-for-one replacement*	*First cost and prior experience*
1-4	-0.13	-0.18	0.11
5-14	0.22	-0.13	0.07
15-49	-0.07	-0.02	0.02
50+	-0.09	0.11	-0.15

We can compare the factors in terms of the total number of units nationwide, as shown in Table 4-15. Energy cost and efficiency become more important decision factors as the number of units increases. Likewise, one-for-one replacement increases as the number of units increases. However, concern with first cost decreases with an increase in the number of units.

Table 4-15. Average Common Area Decision Factor Scores by Total Number of Units Nationwide

Total number of units nationwide	*Energy cost and efficiency*	*One-for-one replacement*	*First cost and prior experience*
1-249	-0.23	-0.18	0.15
250-999	-0.22	-0.09	-0.04
1,000-4,999	-0.11	0.01	-0.02
5,000+	0.05	0.05	-0.22

In summary, we see that as the number of units per complex increases and the total number of units a firm has increases, interest in energy costs and efficiency increases. We attribute this to the fact that larger firms may have more interest because of the total dollars involved and may have the staff and skills to monitor energy costs closely.

We also see that one-for-one replacement increases with the number of units in a complex, the number of complexes, and the total number of units that a firm has. We suspect that several things are going on here. Those with fewer units and fewer properties probably own properties that are less standard in layout and less standard with respect to how appliances are placed. This leads to nonstandard purchases. Also, replacement of equipment is episodic or infrequent which is likely to lead to buying what is available. In addition, because the number of purchases is low, there are unlikely to be standards or contracts from which equipment is purchased.

Finally, we see decreased price sensitivity, decreased concern about prior experience, and increased concern about ease of maintenance and reliability as the size of complexes, the number of complexes, and the total number of units increases. Concern about price leads decision makers to make low cost choices and that in turn leads to less standardization.

Using prior experience reduces search costs. We should also keep in mind that prior experience can include much more than just prior experience with certain equipment, it may also mean prior experience with certain vendors. Finally, ease of maintenance and reliability may be more important for larger operators because of productivity implications. More change outs and more complex change outs over high numbers of properties and units may significantly increase costs. Thus, larger operators are less sensitive to first cost and more sensitive to what it costs to change out equipment. For the large operators, the costs are labor related. For them, the less that has to be done and the more that can be done with lower cost personnel the better. Smaller operators may operate with a smaller number of maintenance personnel who deal with the full range of issues and have broad skills. Because the volume of the work is less they may be more accepting of customized solutions.

5. COMMON AREA ENERGY-USING EQUIPMENT

The detailed data on common area energy-using equipment that were collected on-site at the sample of 541 apartment complexes have been weighted to represent the population of apartment complexes and used to calculate estimates of the saturation of the various types of equipment. Tables with the detailed saturation estimates are provided in Appendix C. A summary discussion of the saturation estimates is provided in this chapter.

Types of equipment for which saturation estimates are presented and discussed include the following:

- Lighting for outdoor common areas
- Lighting for indoor common areas
- Common area laundry equipment
- Swimming pools and hot tubs
- Water heating equipment for common areas
- Heating and cooling equipment for common areas
- Miscellaneous equipment in common areas

5.1 LIGHTING FOR OUTDOOR COMMON AREAS

Outdoor lighting is used at apartment complexes for parking lots, entries, walkways, stairways, and landscaping. Outdoor lighting serves both security and decoration functions. Detailed estimates of the number of complexes with different types of outdoor lighting fixtures, of the installed base of fixtures, and of the connected outdoor lighting load (measured by lamp wattage) are provided in Appendix C. A summary description of the characteristics of outdoor lighting is provided in this section.

Based on lamp wattages, the connected load for outdoor lighting at apartment complexes was estimated to be 210.2 mW. The connected load is distributed across service areas as follows:

- 49.309 mW in PG&E's service area;
- 142.546 mW in SCE/SCG service areas; and
- 18.389 mW in SDG&E's service area.

Table 5-1 shows the connected outdoor lighting load accounted for by different types of lighting in the different service areas.

Table 5-1. Connected Outdoor Lighting Load by Service Areas and Types of Lamps (Load in Megawatts, based on lamp wattage)

Type of Lighting Equipment	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Total Connected Load	210.2	49.3	142.5	18.4
Load by Lamp Type:				
2-foot fluorescent	0.7	-	0.6	-
4-foot fluorescent	24.4	6.1	17.6	0.8
6-foot fluorescent	0.2	-	0.2	
8-foot fluorescent	6.5	1.5	5.0	0.1
Compact fluorescent (pin)	22.3	6.7	13.3	2.2
Compact fluorescent (screw)	2.1	0.8	0.7	0.7
CircleLine fluorescent	3.9	1.1	2.6	0.2
High pressure sodium	26.0	6.4	18.4	1.1
Halogen	6.1	3.6	2.4	0.1
High intensity discharge	2.5	0.4	1.0	1.1
Incandescent	77.7	13.0	55.4	9.3
Incandescent spotlight	5.6	1.3	4.1	0.2
Low pressure sodium	2.1	0.6	1.0	0.5
Metal halide	7.3	3.0	4.0	0.3
Mercury vapor	14.4	3.8	9.6	0.9
Other fluorescent	1.7	0.4	1.3	-
Quartz	6.3	0.2	5.0	1.1
U-tube fluorescent	0.3	0.2	0.1	

For the combined service areas, six types of lighting account for about 82 percent of the connected outdoor lighting load:

- Incandescent 37 percent
- High pressure sodium 12 percent
- Four-foot fluorescent 12 percent
- Compact fluorescent (pin-based) 11 percent
- Mercury vapor 7 percent
- Metal halide 3 percent

5.2 LIGHTING FOR INDOOR COMMON AREAS

Based on lamp wattages, the connected load for lighting indoor common areas at apartment complexes is less than for lighting outdoor common areas. The connected load for lighting indoor common areas was estimated to be 70.0 mW for the combined service areas.

The connected load for lighting indoor common areas is distributed across service areas as follows:

- 21.1 mW in PG&E's service area;
- 42.6 mW in SCE/SCG service areas; and
- 6.3 mW in SDG&E's service area.

Table 5-2 shows the connected indoor lighting load accounted for by different types of lighting in the different service areas. For the combined service areas, four-foot fluorescent and incandescent lighting account for about 76 percent of the connected indoor lighting load. Four other types of lighting account for another 18 percent of the load. The percentages of the connected indoor lighting load accounted for by different types of lighting are as follows.

- Four-foot fluorescent45 percent
- Incandescent31 percent
- Compact fluorescent (pin)7 percent
- Eight-foot fluorescent4 percent
- CircleLine fluorescent4 percent
- Exit sign, incandescent3 percent

For four-foot fluorescents, there is a split among standard efficiency T-12 lamps (40 watts per lamp), energy saver T-12 lamps (34 watts per lamp), and T-8 lamps (32 watts per lamp). For the combined service areas, standard efficiency T-12 lamps account for 72 percent of the four-foot fluorescent lighting load. Energy-saver T-12 lamps account for 20 percent of that load, and T-8 lamps for 7 percent.

Table 5-2. Connected Indoor Lighting Load by Service Areas and Types of Lamps (Load in Megawatts, based on lamp wattage)

Type of Lighting Equipment	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Total Connected Load	70.0	21.1	42.6	6.3
Load by Lamp Type:				
2-foot fluorescent	0.5	0.3	0.2	0.0
4-foot fluorescent	31.3	8.2	19.4	3.7
6-foot fluorescent	0.0	0.0		0.0
8-foot fluorescent	2.9	0.3	2.7	0.0
Compact fluorescent (pin)	5.0	2.1	2.8	0.1
Compact fluorescent (screw)	0.3	0.0	0.1	0.3
CircleLine fluorescent	2.6	0.6	1.8	0.2
Exit sign fluorescent	0.1	0.1	0.1	0.0
Exit sign, incandescent	2.3	0.7	1.5	0.0
Exit sign, LED	0.0	0.0		
High pressure sodium	0.0	0.0		
Halogen	0.2	0.2	0.0	
Incandescent	21.9	7.1	12.9	1.8
Incandescent spotlight	1.1	0.4	0.6	0.1
Low pressure sodium	0.0	0.0		
Metal halide	0.1	0.0	0.1	0.0
Mercury vapor	0.1	0.1		0.0
Other fluorescent	0.3	0.2	0.2	0.0
Quartz	0.1	0.0	0.0	0.0
U-tube fluorescent	1.1	0.7	0.4	0.0

5.3 COMMON AREA LAUNDRY EQUIPMENT

There is common area laundry equipment at about 92 percent of the apartment complexes found in the combined service areas. Common area laundry equipment is found at about 88 percent of the complexes in PG&E's service area, at about 96 percent of the complexes in SCE/SCG's service area, and at about 91 percent of the complexes in SDG&E's service area.

The stock of laundry equipment in apartment complexes consists of about 235,910 clothes washers and 235,380 dryers. The nearly one-to-one ratio between washers and dryers is in accord with the Laundry Room Guide Recommendations of the Multi-Housing Laundry Association that there be one single-load dryer for each washer.

For the combined service areas, there is one common area clothes washer for every 12.2 apartment units. For individual service areas, the ratio is one clothes washers for every 13.2 apartment units in PG&E's service area, for every 11.8 apartment units in SCE/SCG's service area, and for every 11.5 apartment units in SDG&E's service area. These ratios are comparable to the equipment guidelines of the Multi-Housing Laundry

Association, which recommend one pair of washers/dryers for every 8 to 12 units for complexes where families are the predominant residents and one pair for every 10 to 15 units for complexes where young working adults are the predominant residents.

Nearly all of the common area washers and dryers are coin-operated. However, there are several types of arrangements by which the revenue from the machines is distributed. These arrangements and the percentages of clothes washers operated under each arrangement are shown in Table 5-3. (The percentages are derived from responses to the telephone survey.) Across the combined service areas, about 58 percent of the coin-operated washers are operated under a revenue distribution arrangement whereby the apartment complex shares the revenue with the company that provides the laundry equipment. The percentages of washers operated under such an arrangement do vary slightly among the individual service areas.

Table 5-3. Arrangements for Distributing Revenue from Coin-Operated Clothes Washers (Percentages based on number of machines)

Revenue Arrangement for Coin-Operated Clothes Washers	*Combined Service Areas*	*Individual Utility Service Areas*		
		PG&E	*SCE/SCG*	*SDG&E*
Complex owns the equipment and collects all of the revenue	17%	16%	17%	25%
Complex leases the equipment and collects all of the revenue	15%	14%	18%	4%
Complex shares the revenue with the company that provides laundry equipment	58%	59%	56%	65%
Complex provides space to the company that owns the laundry equipment without revenue	3%	2%	4%	0%
Other arrangement	1%	1%	1%	0%
No answer	5%	7%	4%	6%

The distributions of common area clothes washers and clothes dryers by type are shown in Table 5-4.

- Most common area clothes washers are top-loaded, with vertical agitators. Most of the washers draw 1 kW or less (see Appendix C.)
- Most common area clothes dryers are front-loaded and use natural gas. However, across the combined service areas, about 9 percent of the clothes dryers use electricity.

Table 5-4. Numbers of Different Types of Clothes Washers and Clothes Dryers Installed in Common Areas

Type of Clothes Washer or Dryer	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
	Clothes Washer			
All clothes washers	235,910	75,520	133,980	26,410
Top-loaded, vertical agitator	225,580	72,790	126,630	26,160
Top-loaded, horizontal agitator	1,620	-	1,620	-
Front-loaded, horizontal agitator	8,710	2,730	5,730	250
	Clothes Dryers			
All clothes dryers	235,380	75,870	133,370	26,150
Natural gas, front-loaded	210,960	65,360	120,210	25,390
Natural gas, top-loaded	2,800	1,090	1,620	90
Electric, front-loaded	21,040	8,840	11,530	670
Other fuel, front-loaded	580	580	-	-

The age distributions for common area clothes washers and dryers are shown in Table 5-5. Across the combined service areas, just over half of the washers and dryers are between one and five years old. About 27 percent of the washers and dryers are over five years old, and about 13 percent are under one year old.

Table 5-5. Age Distributions for Clothes Washers and Clothes Dryers Installed in Common Areas

Age of Clothes Washer or Dryer	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
	Clothes Washer			
All clothes washers	235,910	75,520	133,980	26,410
Under 1 year	13%	10%	15%	13%
1 to 5 years	54%	51%	53%	66%
5 to 10 years	21%	19%	23%	17%
10 to 15 years	5%	2%	8%	2%
Over 15 years	1%	1%	1%	0%
Age not known	5%	16%	0%	1%
	Clothes Dryers			
All clothes dryers	235,380	75,870	133,370	26,150
Under 1 year	14%	12%	16%	13%
1 to 5 years	52%	49%	52%	67%
5 to 10 years	21%	19%	24%	17%
10 to 15 years	5%	2%	7%	2%
Over 15 years	1%	1%	2%	0%
Age not known	6%	17%	0%	1%

5.4 SWIMMING POOLS AND HOT TUBS

Data were collected regarding the characteristics of swimming pools and hot tubs at apartment complexes.

5.4.1 Swimming Pools

Swimming pools are a common amenity for apartment complexes. For the combined service areas, just over three fourths (77 percent) of the apartment complexes have one or more swimming pools. There are swimming pools at about 74 percent of the complexes in PG&E's service area, at about 80 percent of the complexes in SCE/SCG's service area, and at about 73 percent of the complexes in SDG&E's service area.

The estimated number of swimming pools across the combined service areas is about 25,960. (Some complexes have more than one pool.) As shown in Table 5-6, most of these swimming pools are outdoors. About 56 percent of the pools are not heated, while about 44 percent are heated, mostly with natural gas heating.

Table 5-6. Numbers of Swimming Pools at Apartment Complexes by Location in Complex and Type of Heating

Type of Swimming Pool	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Total number of pools	25,960	9,960	12,880	3,130
Indoor Pools				
Total, indoor pools	370	220	20	130
Not heated	360	210	20	130
Heated with natural gas	10	10		
Outdoor Pools				
Total, outdoor pools	25,590	9,740	12,860	3,000
Not heated	14,110	7,080	4,830	2,210
Heated with natural gas	10,590	2,140	7,660	790
Heated with other fuel	890	520	370	-

All of the swimming pools have circulation pumps. As shown in Table 5-7, these are generally rated at 2 horsepower or less, with total horsepower of the pumps estimated at 47,920 horsepower. A table detailing the distribution of circulation pumps by horsepower rating for individual service areas is provided in Appendix C.

Table 5-7. Numbers and Total Horsepower of Circulation Pumps for Swimming Pools at Apartment Complexes (Combined Service Areas)

Size of Pool Pump (In horsepower	*Number of Pumps*	*Total Horsepower of Pumps*
Totals:	25,960	47,920
1 hp or less	7,280	6,960
1 to 2 hp	15,940	28,300
2 to 5 hp	2,170	7,180
Over 5 hp	240	5,480
Hp not known	330	N/a

Table 5-8 provides additional information on capacities and ages of the estimated 10,590 outdoor swimming pools across the combined service areas that are heated with natural gas. About 63 percent of the gas heating equipment has a capacity rating between 250 and 500 kBtu per hour. About 51 percent of the gas-heated swimming pools are 10 years old or less.

Table 5-8. Distribution of Outdoor Gas-Heated Swimming Pools by Capacity and by Age of Heating Equipment (Combined Service Areas)

Capacity of Pool Heating Equipment	*Number of Pieces of Heating Equipment*
Total number of outdoor pools heated by natural gas	10,590
By capacity	
250 kBtu/hour or less	1,680
250 to 500 kBtu/hour	6,620
Over 500 kBtu/hour	1,090
KBtu/hour not known	1,200
By age of equipment	
Under 1 year	730
1 to 5 years	2,310
5 to 10 years	2,410
10 to 15 years	3,010
Over 15 years	1,820
Age not known	300

5.4.2 Hot Tubs

Hot tubs are found at fewer of the apartment complexes than are swimming pools. For the combined service areas, just over one third (35 percent) of the apartment complexes have one or more hot tubs. There are hot tubs at about 19 percent of the complexes in PG&E's service area, at about 51 percent of the complexes in SCE/SCG's service area, and at about 28 percent of the complexes in SDG&E's service area.

The estimated number of hot tubs across the combined service areas is about 10,380. As shown in Table 5-9, most of these hot tubs are outdoors and are heated using natural gas.

Table 5-9. Number of Hot Tubs at Apartment Complexes by Location in Complex and Type of Heating

Type of Hot Tub	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Total number of hot tubs	10,380	2,380	6,910	1,110
Indoor Hot Tubs				
Total	460	210	260	-
Heated with natural gas	340	210	140	-
Heated with electricity	120	-	120	-
Outdoor Hot Tubs				
Total	9,920	2,170	6,640	1,110
Heated with natural gas	9,510	1,940	6,470	1,100
Heated with electricity	10	10	-	-
Heated with other fuel	210	90	120	-
Heating fuel not known	190	130	50	10

5.5 WATER HEATING EQUIPMENT FOR COMMON AREAS

The stock of water heating equipment at the apartment complexes is estimated to be 173,980 pieces of equipment for the combined service areas. About 28 percent of the stock is in PG&E's service area, about 54 percent in SCE/SCG's service area, and about 18 percent in SDG&E's service area.

The breakdown of the stock of water heating equipment by type is shown in Table 5-10. Nearly 90 percent of the water heating equipment is fired by natural gas, while about 8 percent of the equipment uses electricity to heat the water. The type of equipment used most often to provide hot water to common areas is a natural-gas water heater with a tank. Such equipment accounts for about 77 percent of the installed stock of water heating equipment across the combined service areas. Information pertaining to the characteristics of this type of water heating equipment is summarized here. (Similar information on other types of water heating equipment is provided in Appendix C.)

Table 5-10. Water Heating Equipment for Common Areas by Heating Fuel and Type

Type of Water Heating Equipment	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
All water heaters	173,980	48,950	93,580	31,450
Electric-fired	14,690	480	6,590	7,620
Natural gas-fired boilers	20,110	4,390	14,460	1,270
Natural gas-fired tanks	134,640	43,120	68,960	22,560
Natural gas-fired, other	870	870	-	-
Other water heating fuel	90	90	-	-
Water heating fuel not known	3,580	10	3,570	-

Table 5-11 shows the distribution of the natural gas water heaters according to the size of the tank. About 58 percent of the water heaters have tanks of 80 gallons or less, while about 41 percent have tanks greater than 80 gallons.

Table 5-11. Distribution of Natural Gas Water Heaters by Size of Tank

Size of Tank (Gallons)	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Total number, natural gas water heaters with tanks	134,640	43,120	68,960	22,560
40 gallons or less	47,180	6,790	38,270	2,120
40 to 80 gallons	31,150	14,600	11,860	4,700
80 to 120 gallons	54,120	20,880	18,500	14,740
Over 120 gallons	840	670	110	70
Size not known	1,340	180	220	940

Table 5-12 shows the distribution of the natural gas water heaters when they are classified according to input heating capacity (measured in thousand Btu per hour). About 60 percent of the natural gas water heaters have input heating capacities of 150 kBtu per hour or less.

Table 5-12. Distribution of Natural Gas Water Heaters by Input Heating Capacity

Input Heating Capacity	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Total number, natural gas water heaters with tanks	134,640	43,120	68,960	22,560
75 kBtu/hour or less	64,040	11,700	41,430	10,910
75 to 150 kBtu/hour	17,360	11,000	5,360	1,000
Over 150 kBtu/hour	47,570	19,830	17,480	10,260
Capacity not known	5,680	590	4,700	390

Table 5-13 shows the age distribution of the natural gas water heaters. About 60 percent of the natural gas water heaters have input heating capacities of 150 kBtu per hour or less. Across the combined service areas, about 58 percent of the water heaters are 5 or less years old. However, the age distributions differ among service areas. The percentage of natural gas water heaters that are 5 or less years old is about 40 percent in PG&E's service area, about 65 percent in SCE/SCG's service area, and about 73 percent in SDG&E's service area.

Table 5-13. Age Distribution of Natural Gas Water Heaters

Age of Equipment	*Combined Service Areas*	*Individual Utility Service Areas*		
		PG&E	*SCE/SCG*	*SDG&E*
Total number, natural gas water heaters with tanks	134,640	43,120	68,960	22,560
Under 1 year	34,960	9,180	24,270	1,500
1 to 5 years	43,300	8,230	20,210	14,860
5 to 10 years	29,630	12,080	13,600	3,950
10 to 15 years	22,130	11,140	9,050	1,940
Over 15 years	4,620	2,490	1,820	310

Table 5-14 shows the distribution of natural gas water heaters according to the technical efficiency of the water heaters. As explained in Appendix A, the technical efficiencies were assigned by matching (where possible) against directories produced by the California Energy Commission.

Table 5-14. Distribution of Natural Gas Water Heaters by Thermal Efficiency of Equipment

Thermal Efficiency of Water Heaters	*Combined Service Areas*	*Individual Utility Service Areas*		
		PG&E	*SCE/SCG*	*SDG&E*
Total number, natural gas water heaters with tanks	134,640	43,120	68,960	22,560
0.75	2,980	200	2,780	0
0.76	31,330	12,430	15,520	3,390
0.77	5,690	1,890	3,600	190
0.78	2,120	670	30	1,430
0.79	14,090	4,670	2,840	6,580
0.80	33,660	13,710	12,460	7,490
0.81	4,420	2,320	1,410	690
0.82	3,200	1,130	1,760	310
0.83	320	0	0	320
0.84	1,090	270	30	780
Efficiency not known	35,740	5,820	28,530	1,390

5.6 HEATING AND COOLING EQUIPMENT FOR COMMON AREAS

Across the combined service areas, about two thirds (67 percent) of the apartment complexes have some type of package unit heating or cooling equipment. The percentage with package heating or cooling equipment differed among service areas, with package equipment being installed at 65 percent of the complexes in PG&E's service area, at 78 percent of the complexes in SCE/SCG's service area, and at 33 percent of the complexes in SDG&E's service area. A few complexes were observed to have built-up heating or cooling equipment, but the number of these complexes was too small to allow detailed tabulation.

Table 5-15 shows the number of pieces of installed package HVAC equipment for different system configurations (e.g., heating and cooling, cooling only, heating only) and different types of heating or cooling equipment. Table 5-16 shows the distribution of DX units, heat pumps, gas furnaces, and room air conditioners. Tables showing the distribution of DX units, heat pumps, gas furnaces, and room air conditioners by size and by age as well as efficiency are provided in Appendix C.

Table 5-15. Installed Package HVAC Equipment by System Configuration

System Configuration	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Heating and Cooling				
Heat pumps	4,914	1,069	3,646	199
DX cooling, electric heat	2,287	674	1,540	73
DX cooling, gas furnace	5,233	2,566	2,516	151
Room AC, electric heat	1,696	879	520	297
Wall/floor Heat pumps	2,878	1,771	1,097	9
Cooling Only				
Evaporative Coolers	376	25	348	4
DX cooling	1,777	861	794	121
Packaged Terminal AC	382	5	378	
Room AC	7,757	2,327	4,622	809
Heating Only				
Central gas furnace	1,152	273	879	
Electric heat	189	189		
Package unit gas furnace	2,525	1,075	1,368	82
Wall/floor gas furnace, forced air distribution	108	91	17	
Wall/floor electric heater, natural distribution	1,555	680	875	
Wall/floor gas furnace, natural distribution	49	15	34	
Wall/floor radiant heater, natural distribution	243		232	11

Table 5-16. Distributions by Efficiency for Major Types of Installed Package HVAC Equipment

Equipment Energy Efficiency Classification	*Combined Service Areas*	*Individual Utility Service Areas*		
		PG&E	*SCE/SCG*	*SDG&E*
	DX Cooling Units			
All DX Cooling Units:	9,310	4,100	4,870	350
SEER 8 or less	410	180	230	0
SEER 8 to 9	800	330	410	60
SEER 9 to 10	5,000	2,410	2,450	140
SEER 10 to 11	1,600	690	880	30
SEER 11 to 12	950	160	740	40
SEER Over 12	190	40	230	230
SEER not known	370	290	10	70
	Heat Pumps			
All Heat Pump Units:	7,790	2,840	4,740	210
SEER 8 or less	700	390	250	70
SEER 8 to 9	2,580	610	1,960	10
SEER 9 to 10	2,180	670	1,450	50
SEER 10 to 11	1,560	960	550	40
SEER Over 12	480	30	420	30
SEER not known	300	180	120	0
	Room Air Conditioners			
All Room AC Units:	9,450	3,210	5,140	1,110
SEER 8 or less	420	300	120	0
SEER 8 to 9	4,900	1,550	2,480	870
SEER 9 to 10	3,440	1,000	2,220	220
SEER Over 10	290	0	280	10
SEER not known	400	360	30	0
	Gas Furnaces			
All gas furnace units:	9,070	4,020	4,810	230
AFUE .79 or less	1,750	1,170	580	0
AFUE .80 to .82	6,020	2,710	3,110	190
AFUE Over .82	1,280	140	1,110	30
AFUE not know	20	0	10	10

5.7 MISCELLANEOUS EQUIPMENT IN COMMON AREAS

Various types of miscellaneous and kitchen equipment may also be used in common areas of apartment complexes. The percentage of complexes using different types of equipment is shown in Table 5-17. Estimates of the number of pieces of each type of equipment are provided in Appendix C.

Table 5-17. Percentage of Apartment Complexes with Specified Types of Miscellaneous and Kitchen Equipment in Common Areas

Type of Equipment	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
All complexes	28,650	11,640	13,120	3,890
Fax machines	74%	69%	82%	61%
Copiers	61%	53%	71%	51%
Personal computers	55%	52%	63%	32%
Printers	49%	41%	61%	34%
Water coolers	33%	19%	48%	24%
Soda machines	32%	26%	40%	24%
Coffee makers	32%	19%	46%	25%
Microwaves	15%	9%	19%	17%
Vending machines	9%	4%	17%	2%
Refrigerators	28%	20%	35%	29%
Dishwasher	8%	8%	10%	1%
Garbage disposal	7%	3%	11%	4%
Stove, electric	5%	3%	8%	2%
Stove, natural gas	5%	2%	9%	3%
Ovens, electric	5%	8%	4%	
Ovens, natural gas	3%	2%	3%	2%
Audio equipment	28%	8%	49%	21%
Television	19%	14%	27%	11%
Ceiling/portable fans	25%	18%	30%	32%
Portable heaters	12%	13%	11%	12%

6. COMMON AREA ENERGY EFFICIENCY IMPROVEMENTS

This chapter deals with the types of energy efficiency improvements that apartment complexes have made, the year improvements were made, reasons for making improvements, the role of energy efficiency programs, and future plans for efficiency improvements.

6.1 TYPES OF IMPROVEMENTS MADE

Each respondent in the telephone survey represented a complex where there was a common area equipment survey. Each respondent was asked whether or not six categories of energy efficiency measures had been taken for equipment in the common areas of the complex in which the equipment survey was completed. The six categories of measures were:

- Lighting in internal hallways, rooms or corridors;
- Outdoor lighting and lighting in parking areas;
- Heating or cooling equipment for common area rooms;
- Central boiler for water heating;
- Swimming pool, jacuzzi or spa; and
- Laundry equipment for residents' use.

As shown in Table 6-1, respondents reported that measures had been taken to improve the efficiency of outdoor lighting in more than half of the complexes (55 percent) and lighting in internal hallways, rooms or corridors in slightly fewer than half of the complexes (43 percent). Energy efficiency improvements to common area boilers, laundry equipment, heating and cooling equipment, and swimming pools / jacuzzis/spas, were reported for fifteen percent or fewer of the complexes.

Table 6-1. Types of Energy Efficiency Improvements

Efficiency measures taken	*Percent of complexes*
Outdoor lighting and lighting in parking areas	55%
Lighting in internal hallways, rooms or corridors	43%
Central boiler for water heating	15%
Laundry equipment for residents' use	15%
Heating or cooling equipment for common area rooms	9%
Swimming pool, jacuzzi or spa	8%

6.2 YEAR IMPROVEMENTS WERE MADE

For the most part, the energy efficiency improvements have been completed in recent years. Table 6-2 shows the median year, that is, the year that 50 percent or more of the complexes reported that the improvements were made. More than half the sites that reported lighting improvements reported that they have been done since 1998. The least recent improvements seem to be for heating and cooling equipment for common area use. At least half of the sites reporting efficiency improvements to boilers, laundry equipment and swimming pools report those improvements have been made since 1999.

We are struck by the fact that such a high percentage of efficiency improvements have been recent. Some of this may be due to respondents remembering or having experience with the more recent improvements and being relatively recent in their jobs. It is also possible that much of the activity is a response to recent utility activities.

Table 6-2. Year Measures Were Taken

Efficiency measures taken	*Earliest year changes reported*	*Median year changes reported*
Outdoor lighting and lighting in parking areas	1980	1998
Lighting in internal hallways, rooms or corridors	1983	1998
Central boiler for water heating	1985	1999
Laundry equipment for residents' use	1983	1999
Heating or cooling equipment for common area rooms	1985	1997
Swimming pool, jacuzzi or spa	1997	1999

We did examine whether the age of a complex was related to whether or not energy efficiency measures have been taken. We hypothesized that complexes that were built more recently would be less likely to have installed measures than complexes built in earlier years. We assumed that changes were more likely to be made to older units, and that when changes are made the operator may be likely to take the opportunity to install efficient equipment.

Table 6-3 shows the percentages of complexes that have had efficiency measures installed by year built. There are no statistically significant differences in the installation of efficiency measures by decade in which the complex was built. However, for four of the six categories of efficiency measures, the percentage of complexes in which they were installed is lowest in the 1990s. Thus, there is less of a tendency to have installed equipment in the 1990s. This may be because changes to these units have not yet been made or it may be because these units were made more efficient in the beginning.

Table 6-3. Percentage of Complexes Reporting Energy Efficiency Improvements by Year Complex Was Built

Efficiency measures taken	Year built			
	Pre-1970	1970s	1980s	1990s
Outdoor lighting and lighting in parking areas	58%	52%	52%	53%
Lighting in internal hallways, rooms or corridors	48%	46%	38%	36%
Central boiler for water heating	18%	20%	13%	13%
Laundry equipment for residents' use	19%	20%	19%	14%
Heating or cooling equipment for common area rooms	12%	11%	9%	8%
Swimming pool, jacuzzi or spa	8%	12%	13%	16%

Because a complex can install multiple measures, the percentages do not add to 100.

6.3 REASONS FOR IMPROVEMENT

If respondents indicated that a particular efficiency improvement had been made, they were asked why they made the change based on seven pre-established reasons. The seven reasons were equipment failure, poorly working equipment, aging equipment, the need for safety improvements, the need to make the complex more marketable, improving energy efficiency, and reducing operating costs. The results are shown in Table 6-4.

In every case, improving energy efficiency was cited as the most important reason for making the change. More than 90 percent of the respondents cited energy efficiency as the reason for improvements to outdoor lighting (including lighting in parking areas), internal lighting, and heating or cooling equipment. Between 80 and 90 percent cited energy efficiency as the reason for improvements to laundry equipment and central boilers for water heating. Efficiency was least often cited as a reason for changing swimming pool equipment.

For all types of equipment but one, reducing the cost to the company was the next most frequently cited reason for changing the equipment. However, the percentage citing reducing the cost to the company is half or less of those citing improving energy efficiency as a reason. These differences are dramatic, and they suggest that many respondents may not perceive the linkage between energy efficiency and reducing energy costs or that energy costs may not be as important to them as being viewed as energy efficient. In our one-to-one interviews, many people noted that electricity was a very small percentage of operating costs and in almost every case they noted that water and sewerage costs were higher.

Table 6-4. Reasons for Installing Measures

Efficiency measures	*Reasons for Installing Measures*						
	Equipment failure	*Poorly working equipment*	*Aging equipment*	*Improve safety*	*Make complex more marketable*	*Improve energy efficiency*	*Reduce company operating cost*
Outdoor lighting and lighting in parking areas	6%	8%	4%	22%	6%	95%	43%
Lighting in internal hallways, rooms or corridors	10%	9%	3%	13%	4%	93%	42%
Central boiler for water heating	35%	4%	7%	5%	0%	84%	37%
Laundry equipment for residents' use	19%	7%	27%	4%	5%	83%	40%
Heating or cooling equipment for common area rooms	29%	18%	4%	7%	<1%	95%	14%
Swimming pool, jacuzzi or spa	14%	8%	7%	12%	10%	63%	34%

None of the other reasons for replacing any of the other technologies exceeded 35 percent, but there were some predictable differences within the technology groups. For instance, equipment failure was more often an important motivation for changing boilers and heating and cooling equipment than in changing other technologies. Safety improvements were a more important motivator for outdoor lighting changes than for other technologies. Poorly working equipment was a motivator for changing out heating and cooling units. Aging was more a factor for laundry equipment change-outs than it was for other equipment.

From a program perspective, it is important to recognize that decision makers may not see the connection between energy efficiency and reducing energy costs. Another possibility is that the total cost of energy in a complex is not a very strong incentive to improve energy efficiency. The promotion of energy efficiency improvements may be more successful if it is promoted for other reasons. It may be more effective to promote equipment changes for reasons such as safety, reliability and replacing poorly working equipment.

Program designers need to think creatively about ways to promote efficiency. For instance, programmers might look into the possibilities of partnering with insurance companies to develop public area lighting safety programs. Program designers might want to implement programs built around predictive maintenance that would help to spot potential problems and lead to early changes of equipment. Program designers may want to promote equipment that is both efficient and reliable and stress the reduction in costs associated with the reliability. The energy cost incentive is much less attractive than other types of incentives.

6.4 ROLE OF ENERGY EFFICIENCY PROGRAMS

Apartment operators were asked whether or not they had participated in energy efficiency programs sponsored by a California utility. Sixteen percent of the operators said that they had. We asked what type of programs. The preponderance of these programs was lighting programs (six percent of operators). Quite a few indicated that they had participated in water programs, mostly low-flow toilet and showerhead programs (four percent of the operators). There were a few who said that they had participated in appliance rebate programs (less than one percent of operators). About five percent identified rebate programs in general or programs like the SMUD tree program. Significantly, six operators reported dissatisfaction with the program either in terms of the quality of the equipment or the quality of the lighting. One or two indicated that they had replaced the equipment with less efficient equipment as a result of their dissatisfaction.

About 19 percent of firms that manage apartments have participated in utility programs, compared to about 14 percent for firms who own and manage apartments. However, the difference is not statistically significant.

We examined the responses of those who said that they had participated by the year the inventoried complex was built to see if those with older units were more likely to say they had participated. The results are shown in Table 6-5. Respondents with units built in 1970 were more likely to have participated. The differences are statistically significant.

Table 6-5. Percent of Operators That Have Participated in a California Utility Sponsored Energy Efficiency Program by Year Complex Was Built

	Year built			
	Pre-1970	*1970s*	*1980s*	*1990s*
Participated in California utility program	20%	22%	9%	8%

Chi-square = 10.5 with 3 df; p = 0.015 level

Table 6-6 shows that there were no statistically significant differences in terms of the size of the complex with respect to whether or not they had participated in utility energy efficiency programs.

Table 6-6. Percent of Operators That Have Participated in a California Utility Sponsored Energy Efficiency Program by Number of Units in Complex

	Number of Units in Complex			
	1 –79	*80 - 119*	*120 – 249*	*250+*
Participated in California utility program	16%	18%	15%	17%

Chi-square = 0.5 with 3 df; p = 0.928 level

However, there are differences in participation in terms of the number of properties that apartment operators own. Table 6-7 shows that the largest operators and the operators with 5-14 units are more likely to have participated in utility programs (34 percent and 21 percent, respectively) than the smallest operators and the operators with 15-49 units (13 percent and 11 percent, respectively). Overall, the largest operators indicate that they have participated more often and by a substantial margin.

Table 6-7. Percent of Operators That Have Participated in a California Utility Sponsored Energy Efficiency Program by Number of Properties Owned or Managed by Operator

	Number of Properties Owned or Managed			
	1 -4	*5 - 14*	*15 - 49*	*50+*
Participated in California utility program	13%	21%	11%	34%

Chi-square = 116.6 with 3 df p = 0.001 level

Although the percentages differ and the differences are not quite statistically significant, a very similar relationship is evident when participation is examined in relation to the total number of units owned or operated by an operator. These results are shown in Table 6-8.

Table 6-8. Percent of Operators That Have Participated in a California Utility Sponsored Energy Efficiency Program by Number of Units Operator Owns or Manages

	Number of Units Owned or Managed			
	1 - 249	*250 – 999*	*1,000 - 4,999*	*5,000+*
Participated in California utility program	12%	26%	18%	26%

Chi-square = 5.3 with 3 df p = 0.150 level

In the previous section, we examined whether or not respondents reported efficiency improvements to common areas. Earlier we reported that 55 percent of the valid cases with data had done a lighting retrofit. If we consider all cases instead of just the cases with valid data, 50 percent of the respondents indicate that they have made one of the common area efficiency improvements.

When we compare those who say they have made at least one of the common area efficiency improvements with those who say they have used a utility sponsored efficiency program, Table 6-9 shows that only about 20 percent of those who have made common area improvements have used one of the utility efficiency programs. Twelve percent of those who had not made common area improvements but who may have made improvements to individual units say that they have used utility programs. In other words, the number of people who claim to have made efficiency improvements is 2.5 times the number of people who have used utility programs. Many people claim to be making efficiency improvements in common areas without the benefit of utility programs.

Table 6-9. Percent of Complexes With and Without Common Area Efficiency Improvements Who Have Used a Utility Program

	No common area efficiency improvements	*Common area efficiency improvements*
Have used utility program	12%	21%

6.5 PLANS FOR FUTURE IMPROVEMENTS

Respondents were asked about their plans for changing the complex that was inventoried. Based on past experience, we know that firms will often make efficiency upgrades when making other changes. Thus, we asked about their general plans and plans that they might have for efficiency improvements. Finally we asked about changing the way energy and water are metered because several people had indicated plans to make changes to metering arrangements during the in-depth interviews.

6.5.1 General improvements

Twenty-seven percent of the respondents said that they were planning to make some change to the complex in the next three years. Most indicated that these changes will be for the renovation and replacement of obsolete features in the complex. As expected, units built prior to 1970 and in 1980 are more likely to have plans to make changes. Table 6-10 presents the types of changes planned in the next three years.

Table 6-10. Planned Changes to Complex in Next Three Years: Overall and by Year Built (Percent of Complexes)

Planned Change	When Built				Overall
	Pre-1970	1970s	1980s	1990s	
Convert to condominium	0%	0%	0%	4%	1%
Renovate or replace obsolete features	25%	23%	11%	18%	20%
Combine units to create larger units	0%	0%	7%	0%	2%
Change the tenant population	2%	7%	4%	0%	4%
No change	73%	70%	78%	78%	73%

We examined some of the organizational variables that might help us to identify who has plans for improvements to common areas in the next three years. There were no differences by whether properties were company owned and managed or managed but not owned. Also, there were no differences by the number of units in the complex that was inventoried.

However, Table 6-11 and Table 6-12 show that there were statistically significant differences in terms of the number of properties owned company-wide and the total number of units owned by a firm. Those who owned more properties were more likely to have improvement plans. Likewise, having more units was almost statistically significant.

Table 6-11. Percent of Operators That Have Improvement Plans by Number of Properties Owned or Managed by Operator

	Number of properties owned or managed			
	1 -4	5 - 14	15 – 49	50+
Have improvement plans	8%	19%	12%	35%

Chi-square = 21.03 with 3 df p = 0.000 level

Table 6-12. Percent of Operators That Have Improvement Plans by Number of Units Owned or Managed by Operator

	Number of units owned or managed			
	1 – 249	*250 – 999*	*1,000 - 4,999*	*5,000+*
Have improvement plans	13%	12%	27%	27%

Chi-square = 7.4 with 3 df p = 0.059 level

It is not necessarily surprising that larger firms have "long" range plans, but from a programmatic perspective it means that there may be "time" to promote energy efficiency within these firms. It appears that firms with fewer units and properties are less likely to have plans and may therefore respond in shorter time frames. From a programmatic perspective this may mean that market transformation programs may need to deal with more episodic behaviors. Also, we should keep in mind that no more than 35 percent of the firms in any of the groups said that they had plans in the next 3 years which means that most firms operate in terms of short-term response.

If respondents told us that they had plans, we asked about the types of equipment included in those plans. Table 6-13 shows the distribution of equipment items that firms propose to install in common areas. Lighting (seven percent) is clearly the most common efficiency measure. Air conditioning was the next most common and the remaining equipment was in a range of one to two percent.

Lastly, with respect to common area equipment, we asked those who did not have plans to improve energy why they did not. Of those who said that they did not have any plans, 35 percent said that they had already taken actions to improve energy efficiency, 27 percent said that they had no interest and 12 percent provided some different reason such as the complex was new or that they only made decisions when equipment failed. The remaining 26 percent gave no reason.

Table 6-13. Percent of Complexes Planning to Install Efficient Equipment in Common Areas in Next Three Years

Proposed efficiency measures	*Percent of complexes*
High efficiency lighting indoors	7%
High efficiency lighting outdoors	7%
Solar assisted pool heaters	2%
Heat recover units in pools	<1%
Efficient clothes washers	2%
Efficient air conditioning	4%
Efficient furnaces	1%
Efficient central boilers	2%

6.5.2 Meters, Meter Conversions, and Split Incentives

There has been a great deal of discussion about split incentives in the market transformation literature. One of the most frequently cited examples is apartment complexes where it is assumed that owners and managers are less likely to make efficiency improvements to units with common meters than to units that are individually metered. The argument is that operators are not incentivized to make the units efficient if the renters are paying for the energy and resource bills.

Respondents were asked if the property that was inventoried had individual or common meters. As shown in Table 6-14, 76 percent of the units had individual electric meters, 57 percent had individual gas meters, and nine percent had individual water meters.

Table 6-14. Type of Metering Equipment
(Percent of Complexes)

Utility	*With individually metered units*	*With common meters*
Electric	76%	24%
Natural gas	57%	43%
Water	9%	91%

We also learned that there were few plans to convert from common to individual meters. Table 6-15 shows that only 11 percent of those with common electric meters, four percent of those with common gas meters, and six percent of those with common water meters plan to convert. The greatest potential to convert group meters to individual meters (in terms of number of complexes) is the water market. This is due to the fact that 91 percent of apartment unit water meters in California are not now individually metered, water is expensive, and the supply of water resources is restrained and frequently rationed.

Table 6-15. Conversion Plans for Commonly Metered Complexes
(Percent of Complexes with Common Meters)

Utility type	*Plans to convert to individual meters*	*No plans to convert to individual meters*
Electric	11%	89%
Natural gas	4%	96%
Water	6%	94%

We examined the data to see if we could find support for the idea that there would be fewer efficiency measures because of split incentives. If the split incentive hypothesis is correct, then we would expect to find the higher percentage of respondents in the common meter column in each case.

We do not have an explicit measure of the efficiency of the equipment in the complexes so we used three proxy variables. Each of the proxy variables is based on the respondents' replies to questions about the complex.

- The first proxy is whether the respondent indicated that any efficiency improvements had been installed in the common area.
- The second is whether the respondent indicated that utility programs had been used to upgrade the efficiency of equipment in the common area.
- The third is whether the respondent indicated that utility programs had been used to improve the efficiency of equipment in tenant units.

When we examine the results in Table 6-16, we see that there is no significant difference in the implementation of efficiency measures in common areas between complexes with common electric meters and complexes with individually metered units. Further, we see that complexes with individually metered units have higher reported participation rates in utility programs aimed at both the common areas and tenant units. In other words, the split incentive hypothesis is contradicted for electricity.

For natural gas we see that the higher percentage of complexes with common meters had implemented common area measures but that there were no statistically significant differences for participation in utility programs aimed at common areas and tenant units. Thus, there is mixed support for the split incentive hypothesis. Many of the improvements may have occurred before programs were available but operators appear to be taking equal advantage of the efficiency programs.

For water meters we see that there were no differences in terms of measures that are implemented but that operators with common area water meters are taking greater advantage of utility efficiency programs. Here there is some support for the split incentive hypothesis.

At least for electricity and gas there is little indication that energy efficiency programs are being adopted in relation to cost incentives. Indeed for electricity, people are adopting even though there is no real incentive. This is consistent with the earlier findings that people made improvements for reasons of efficiency. Many fewer respondents cited cost as a reason for making them.

Table 6-16. Individually Metered Units by Indicators of Activity to Install Efficient Equipment

	Percent		Chi-square	Significance
	Common meters	Individual meters		
	Electricity			
Indicated common area energy efficiency improvements	78%	74%	0.7	0.415
Indicated participation in utility sponsored common area efficiency program	73%	87%	5.7	0.017
Indicated participation in utility sponsored affecting tenant units efficiency program	75%	92%	7.4	0.007
	Natural gas			
Indicated common area energy efficiency improvements	67%	48%	13.4	0.000
Indicated participation in utility sponsored common area efficiency program	59%	50%	1.8	0.18
Indicated participation in utility sponsored affecting tenant units efficiency program	57%	58%	0.1	0.909
	Water			
Indicated common area energy efficiency improvements	9%	9%	0.1	0.910
Indicated participation in utility sponsored common area efficiency program	11%	1%	6.0	0.015
Indicated participation in utility sponsored affecting tenant units efficiency program	10%	0%	5.8	0.016

7. MARKET BARRIERS TO PURCHASING ENERGY EFFICIENT EQUIPMENT FOR COMMON AREAS

This chapter identifies and analyzes barriers that might discourage operators of apartment complexes from purchasing energy efficiency equipment. For example, operators may not know about efficient equipment options. They may perceive that efficient equipment may come with a cost premium. They may not have capital or they may perceive that efficient equipment is less reliable than standard equipment. These perceptions, beliefs and experiences represent potential roadblocks to transforming California's market for energy efficient equipment in apartment complexes.

As part of the telephone interview, respondents were asked to rate six potential barriers on a 10-point scale. The results are shown in Table 7-1. Reliability was rated the most important barrier (7.8) to making efficiency improvements. Forty-three percent of the respondents rated this as "very important".

Table 7-1. Barriers to Purchasing Energy Efficient Equipment

Barrier	*Mean rating*[1]	*Percent of complexes rating as a 10*
Reliability concerns	7.8	43%
Low or non-existent payback	6.8	27%
Higher cost of energy efficient equipment	6.6	19%
Lack knowledge of energy efficient options	5.8	15%
Lack capital	5.7	21%
Lack experience with energy efficient equipment	5.7	17%

[1] Based on a 1 - 10 scale where one means not at all important and ten means very important

Lower or non-existent paybacks and the perceived higher cost of energy efficient equipment were rated next highest although the average scores of 6.8 and 6.6 are somewhat lower than for reliability. About ten percent more of the respondents rated low or non-existent paybacks as "very important" than rated perceived higher cost of energy efficient equipment as "very important." Lack of knowledge, lack of capital and lack of experience had average importance ratings of about 5.7. Between 15 and 21 percent of the respondents rated these as "very important."

As average relative importance scores go, none of these scores is very high. An average importance score of 5 can be interpreted to mean that barrier is neither important nor unimportant. Thus, the last three items in the list are barriers but we should exercise caution about attaching too much importance to them relative to energy efficiency.

Perhaps one way of interpreting the results for the last three items is to say that capital, knowledge, and experience are concerns but not overriding ones.

The important finding here is that reliability is perceived to be the most important obstacle to using energy efficient equipment and it is perceived to be more important than the cost of the equipment or low or non existent paybacks. As was pointed out in an earlier section, reliability represents a “hassle factor" which potentially imposes costs on apartment operators in terms of increased maintenance. These costs can be substantially greater than the cost of the piece of equipment. The programmatic implications are that market transformation programs need to place a priority on addressing the reliability issue. Reliability is a key "relative advantage" of a product. The issue can be addressed by promoting only products that have high reliability and by providing reliability information.

The importance respondents attach to low or nonexistent payback can be interpreted in at least three different ways:

- They do not believe that they will recoup the increased marginal costs of efficient equipment.
- They do not understand the relationship between increased cost of equipment and long-term savings.
- There is a predisposition to the short-term gains associated with lower cost as opposed to the longer-term gains from savings.

We are not in a position to sort out the relative importance of these three explanations but we can point out that each of the explanations requires a different intervention in terms of market transformation initiatives.

We attempted to examine these six items using the factor analytic technique previously described. When we did so we only found a single factor which suggests that these issues are very much intertwined with one another with respect to decision making.

We can examine these barriers with respect to our key firmographic characteristics. Table 7-2 shows that equipment reliability is slightly more important for firms that own and manage (8.0) than for firms that just manage (7.7). Lack of capital is less of a barrier for firms that own and manage (5.2) than it is for firms that just manage (5.7). Neither of these differences is large. It makes sense that owner/operators, who have a greater financial stake in apartment complex profitability, value reliability more than contract operators do. It is also not surprising that lack of capital is less of a barrier for the owners (5.2) who directly control decisions about capital allocation than firms that just manage (5.7) who do not.

Table 7-2. Average Rating of Importance of Barriers To Purchasing Energy Efficient Equipment by Owner or Contract Management Operated

Barrier	Mean rating[1]	
	Owns and manages	Manages but does not own
Reliability concerns	8.0	7.7
Low or non-existent payback	6.8	6.9
Higher cost of energy efficient equipment	6.3	6.4
Lack knowledge of energy efficient options	5.7	5.8
Lack capital	5.2	5.7
Lack experience with energy efficient equipment	5.7	5.5

[1] Based on a 1 - 10 scale where one means not at all important and ten means very important

We assessed the importance of barriers by the age of the complex that was the target of the technology inventory. The results are shown in Table 7-3. With the possible exception of low or non-existent payback, there is no consistent trend in the average importance attached to the barriers and age of the complex. Low or non-existent payback is of less importance for apartment operators of units built in the 1990s than for apartment operators with units built in prior decades. Reliability is statistically more important for people with units built before 1970 and in the 1980s compared to the importance of reliability for firms with units that were built in the 1970s but not statistically different from units built in the 1990s. Capital is a less important issue for firms with units built pre-1970 and in the 1990s compared to firms with units built in the 1970s and the 1980s.

Table 7-3. Average Rating of Importance of Barriers by When Built

Barrier	Mean Rating by When Built			
	Pre-1970s	1970s	1980s	1990
Reliability concerns	8.2	7.3	8.2	7.7
Low or non-existent payback	7.1	7.1	6.7	5.4
Higher cost of energy efficient equipment	6.2	6.8	6.9	6.1
Lack knowledge of energy efficient options	6.2	5.6	5.9	6.0
Lack capital	5.0	5.7	6.3	4.8
Lack experience with energy efficient equipment	5.9	5.6	5.6	6.6

When we analyzed the average importance of barrier ratings by the number of units in the inventoried complex, we found no significant differences for any of the ratings. These results are shown in Table 7-4.

Table 7-4. Average Rating of Importance of Barriers by Number of Units in Complex

Barrier	Number of Units in Complex			
	1 to 79	80 to 119	120 to 249	250+
Reliability concerns	7.9	7.6	8.0	8.0
Low or non-existent payback	6.8	6.8	7.3	6.5
Higher cost of energy efficient equipment	6.6	6.6	6.7	6.6
Lack knowledge of energy efficient options	5.7	5.8	5.6	6.4
Lack capital	5.8	5.5	5.7	5.9
Lack experience with energy efficient equipment	5.8	5.6	5.3	6.5

When we examined the average importance attached to the different barriers by the number of properties owned or managed by the apartment operator, there were no general trends in the data, we found only two significant differences in average scores (reported in Table 7-5). The smallest operators were more likely to rate the lack of knowledge as a barrier when compared to operators with 15-49 properties. The largest operators were less sensitive to not having a payback when compared with the operators who own or manage 5 to 14 properties.

Table 7-5. Average Rating of Importance of Barriers by Number of Properties Owned or Managed by Apartment Operator

Barriers	Number of Properties			
	1-4	5-14	15-49	50+
Reliability concerns	7.8	7.6	8.1	8.0
Low or non-existent payback	7.0	7.7	7.1	6.6
Higher cost of energy efficient equipment	7.2	6.7	6.7	6.7
Lack knowledge of energy efficient options	6.7	6.2	5.4	5.9
Lack capital	5.7	6.0	5.3	6.2
Lack experience with energy efficient equipment	5.9	6.3	5.4	5.9

When we examined the importance of barriers by the total number of units owned or operated by apartment operators, there were no clear trends. There were only three statistically significant differences in these results, as reported in Table 7-6. All of these were associated with knowledge. Firms that own or manage 1,000 to 4,999 units attached significantly less importance to knowledge than did the firms from any of the other size groups.

Table 7-6. Average Rating of Importance of Barriers by Total Number of Units Owned or Operated by Apartment Operators.

Barriers	Number of Units Owned or Managed			
	1 - 249	250 - 999	1,000 - 4999	5,000+
Reliability concerns	7.6	7.2	7.7	7.8.
Low or non-existent payback	6.7	7.0	7.1	6.1
Higher cost of energy efficient equipment	6.6	7.0	6.6	6.8
Lack knowledge of energy efficient options	6.4	6.1	4.9	6.1
Lack capital	6.0	5.0	5.7	5.5
Lack experience with energy efficient equipment	5.5	5.9	4.9	5.6

In summary, respondents attached some importance to each of the barriers that they were asked to rate. On average none of the barriers were rated as being "very important," that is, a 10. Many were rated slightly above average meaning that they were viewed as neither important nor unimportant. The highest average general rating of importance was 7.8 for reliability. The general rating of lack of capital was 5.2. The factor analysis suggests that the respondents do not really differentiate among the barriers. When we examined the barriers by the key characteristics of firms we found few statistically significant differences in the means. Indeed, there were so few statistically significant relationships that probabilistically, the significant correlations could have happened by chance. These data do not provide much support for the idea of dealing with barriers from a programmatic perspective.

8. ENERGY EFFICIENCY IN TENANT UNITS

Previous chapters have focused primarily on apartment complexes and their common areas. However, information was also collected in the on-site and telephone surveys that pertain to decisions made by operators of apartment complexes that can affect energy efficiency improvements to individual units. In this chapter we use that information to address the issue of who makes the decisions regarding equipment in individual units and the criteria that they use in making the decision.

8.1 APPLIANCES FOR INDIVIDUAL UNITS

As part of the on-site data collection, data were collected regarding appliances that were provided to tenants in their units and who owned the appliances that were provided.

Table 8-1 shows the percentages of complexes for which different types of appliances were available to tenants in their units. While almost all units have refrigerators in the units, only 5 percent have trash compactors.

Table 8-1. Percent of Apartment Complexes That Have Appliances in Individual Units

Appliance	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
All complexes	28,650	11,640	13,120	3,890
Refrigerator	97%	100%	94%	100%
Clothes washer	12%	16%	9%	7%
Clothes dryer	12%	16%	9%	7%
Dishwasher	69%	68%	70%	67%
Microwave	70%	70%	75%	50%
Trash compactor	5%	12%	1%	0%
Wall/window air conditioner	34%	32%	34%	37%
Individual unit air conditioning	44%	43%	50%	29%
Individual unit heating equipment	93%	96%	88%	98%
Individual unit water heater	41%	42%	44%	26%

Table 8-2 shows the percentage of complexes that own the appliances that are provided to tenants in the units. For the PG&E and SDG&E service areas, the apartment complex generally owns the refrigerators in individual units; however, complexes in the SCE/SCG service area are less likely to own the refrigerators.

Table 8-2. Percent of Apartment Complexes That Own Appliances That Tenants Have in Individual Units (Base for Percentage is Complexes that have appliances in units)

Appliance	Combined Service Areas	Individual Utility Service Areas		
		PG&E	SCE/SCG	SDG&E
Refrigerator	69%	99%	32%	97%
Clothes washer	64%	70%	47%	94%
Clothes dryer	64%	70%	48%	94%
Dishwasher	99%	100%	99%	100%
Microwave	18%	21%	16%	18%
Trash compactor	100%	100%	100%	100%
Wall/window air conditioner	97%	100%	95%	100%
Individual unit air conditioning	100%	100%	100%	100%
Individual unit heating equipment	99%	99%	99%	97%
Individual unit water heater	99%	100%	100%	94%

8.2 DRIVERS OF DECISION MAKING FOR INDIVIDUAL UNITS

Apartment operators obtain appliances for individual units (e.g., refrigerators, dishwashers, etc.) from three primary sources. As shown in Table 8-3, 43 percent go to local distributors or wholesalers, 32 percent to manufacturers or manufacturers distributors, and 29 percent go to a local dealer or outlet store such as the Home Depot or Circuit City.

Table 8-3. Where Appliances Are Purchased

Where appliances are purchased	Percent of complexes
Local distributor or wholesaler	43%
Manufacturer or manufacturer's distributor	32%
Local dealer or outlet store	29%

As can be seen in Table 8-4, about half of apartment managers and owners (52 percent) purchase appliances through pre-negotiated contracts. Thirty-nine percent purchase appliances for apartments by making a selection from models available at the time of need, and 12 percent purchase appliances through a more formal and pre-established bidding process. This suggests that existing contracts and relationships with vendors is the conduit through which most appliances are purchased for the apartment market in California.

Table 8-4. How Appliances Are Purchased

Appliance purchasing practices	*Percent of complexes*
Pre-negotiated contract	52%
Selection from models available at time of need	39%
Bidding process	12%

Table 8-5 shows that where an operator buys and how he/she buys are very closely related. If you buy from a manufacturer, you are more likely to buy on the basis of pre-negotiated contract. If you buy from a local dealer or outlet, you are more likely to select from the available models at the time of purchase. If the operator uses a distributor, the operator is most likely to have a pre-negotiated contract followed by selecting from the available models. Bidding processes mostly involve local distributors. Based on what we were told in the one-to-one interviews, a number of people may actually have contracts with Sears or Circuit City. That explains the modest percent (22 percent) who buy from "local dealers" but who have pre-negotiated contracts.

Table 8-5. Method for Purchasing Appliances by Where Apartment Operators Buy

Where Buy Appliances	*Pre negotiated contract*	*Bidding process*	*Select from available models*
Local dealer / outlet	22%	5%	74%
Distributor / wholesaler	47%	23%	30%
Manufacturer or manufacturer's distributor	80%	4%	16%

Percentages are by row.

Table 8-6 shows that there are also differences in where and how appliance purchases are made with respect to organizational characteristics. Companies that own and manage facilities are about evenly split in where they buy. Companies that manage are most likely to use distributor wholesalers followed by manufacturers. We attribute this to the fact that management companies tend to be more locally oriented but are probably large enough to want to purchase on a contractual basis.

Table 8-6. Where Operators Buy Appliances by Whether They Own and Manage or Manage Only

Where Buy Appliances	*Company owns and manages*	*Company manages only*
Local dealer / outlet	30%	21%
Distributor / wholesaler	36%	47%
Manufacturer or manufacturer's distributor	33%	32%

Chi-square = 6.3, df = 2, p = .043

When we compare where appliances are purchased by age of the inventoried complex (as shown in Table 8-7), appliances purchased for the oldest units are more likely to be purchased at local dealers. Appliances purchased for units built in the 1990s are most likely to have been purchased at distributors or wholesalers and least likely from manufacturers. We believe that the relationships in this table have to do with the relationship between management patterns and age.

Table 8-7. Method of Purchasing by Age of Complex

Method of Purchasing	*When Built*			
	Pre-1970	*1970s*	*1980s*	*1990s*
Local dealer / outlet	38%	24%	21%	29%
Distributor / wholesaler	35%	42%	41%	62%
Manufacturer or manufacturer's distributor	27%	34%	39%	8%

When we considered location of purchase by the number of units in the complex (as shown in Table 8-8), appliances for complexes with smaller numbers of units were purchased at local dealerships while appliances for large units were purchased from manufacturers. About the same number are purchased from distributor/wholesalers regardless of the number of units.

Table 8-8. Method of Purchasing by Number of Units in Complex

Method of Purchasing	*Number of units in complex*			
	1 -79	*80 – 119*	*120 - 249*	*250+*
Local dealer / outlet	32%	26%	16%	9%
Distributor / wholesaler	39%	44%	41%	41%
Manufacturer or manufacturer's distributor	29%	30%	43%	50%

When we look at where appliances are purchased by the number of properties that are owned (as shown in Table 8-9), it is clear that the small firms purchase from local dealers, the medium size firms tend to purchase from distributors and wholesalers or through manufacturers, and the largest firms purchase through national contracts.

Table 8-9. Method of Purchase by Number of Properties Owned or Managed

Method of Purchasing	*Number of properties owned or managed*			
	1 -4	*5 - 14*	*15 - 49*	*50+*
Local dealer / outlet	44%	14%	11%	19%
Distributor / wholesaler	38%	46%	54%	35%
Manufacturer or manufacturer's distributor	18%	40%	35%	46%

The same pattern holds when we examine the data with respect to the total number of units operated or managed by the apartment operators. (See Table 8-10.) Those who own the fewest units are most likely to purchase from local dealers. Those with the largest number of units are most likely to purchase from national contracts.

Table 8-10. Method of Purchasing Appliances by Total Number of Units Owned and/or Managed

Method of Purchasing	*Number of units owned and/or managed*			
	1 – 249	*250 – 999*	*1,000 – 4,999*	*5,000+*
Local dealer/outlet	43%	15%	22%	6%
Distributor/wholesaler	45%	38%	58%	41%
Manufacturer or manufacturer's distributor	12%	47%	19%	53%

The implication of these findings for market transformation programs is quite clear. The targets should be the handful of national manufacturers with their national contracts; major local wholesalers and distributors who may number less than 100 who service apartment owners; and Sears, Best Buy and Circuit City who sell to the small volume purchasers.

Finally, we examined decision making criteria used in making appliance purchases. Table 8-11 shows that when asked to rate various criteria on a 10-point scale (10 being most important), respondents rated reliability as the most important factor (9.3) in choosing appliances for apartment complexes. Nearly three-fourths of the respondents (72 percent) rated this factor very important (i.e., a 10). The hassle of having to deal with equipment failures is very strong. Three other criteria had similarly high ratings, energy costs when the company owning or managing the apartment complex pays (9.1), energy

efficiency (9.0), and ease of maintenance. Sixty-six, 67, and 63 percent of respondents respectively rated these criteria as 10s.

Table 8-11. Importance of Appliance Selection Criteria for Individual Units

Factors	*Mean rating (1-10 scale)*	*Percent of complexes rating as a 10*
Performance reliability	9.3	72%
Energy costs when company pays utility cost	9.1	66%
Energy efficiency	9.0	67%
Ease of maintenance	9.0	63%
Energy cost when tenant pays utility cost	8.3	54%
Use company's purchasing guidelines	8.1	57%
Price or first cost	8.1	41%
Prior experience with the equipment	7.9	37%
Replacing equipment with an identical or nearly identical model	6.5	26%

As was the case with the discussion of decision criteria about equipment in the common area, reliability and ease of maintenance emerged at the top of the list. Again, we believe that this is because the cost of labor relative to the cost of equipment is quite high. When asked in the one-to-one interviews about the replacement of appliances, most of those who were interviewed said that unless there was an obvious simple fix for something like a refrigerator, the usual procedure is to replace it. Several people pointed out that it does not take many hours of labor to reach the cost of a $200 to $300 refrigerator.

In a manner similar to that used earlier, we factor analyzed the decision criteria associated with appliance decision making. The solution resulted in two factors explaining 38 percent and 14 percent respectively. Table 8-12 shows the two factors. The first captures the importance of efficiency, energy cost, maintenance and reliability. The second captures a more mechanistic approach to purchasing focusing on one-for-one replacement, first cost, and experience.

As we did in the earlier section, we examined these factors in relation to the key organizational variables, who manages, age of complex, size of complex, number of properties owned or managed, and number of units owned and managed.

Table 8-12. Factor Loadings for Appliance-Related Decision Criteria

Equipment selection criteria	*Efficiency, energy cost and maintenance*	*One-for-one replacement*
Replacing equipment with an identical or nearly identical model	0.349	0.613
Purchasing using company guidelines	0.557	-0.020
Price or first cost	0.446	0.522
Prior experience with the equipment	0.528	0.515
Reliability	0.640	-0.143
Ease of maintenance	0.660	0.114
Energy efficiency	0.745	-0.388
Energy cost when the company pays for the utility	0.738	-0.219
Energy cost when the tenant pays the utility cost	0.737	-0.328

When we examined these variables we found no consistent patterns. There were no statistically significant differences on either factor by whether companies owned and managed or just managed. When we examined the factors with respect to the age of properties we found that firms with the newer properties scored higher on both factors. We also found that firms with the largest complexes had the highest score on factor 1 but that there were no other statistically significant differences but that there were not statistically significant differences in factor 2. The relationship between these factors and number of properties and number of units company-wide is mixed. There were some statistically significant relationship but no clear trends.

8.3 PARTICIPATION IN APPLIANCE RELATED ENERGY EFFICIENCY PROGRAMS

Respondents to the telephone survey were asked whether they had participated in appliance-related energy efficiency programs sponsored by utilities. The results are shown in Table 8-13.

Among the 14 percent of the apartment operators who have participated in utility appliance energy efficiency programs, 28 percent reported participating in refrigerator programs, nine percent in low-flow shower head programs, seven percent in weather-stripping, SMUD, and low-flush toilet programs. This is followed by four percent participating in appliance rebate programs, three percent in a water heater tank insulation program, and two percent in water conservation programs. Less than one percent of the market has participated in dishwasher, stove, air conditioner, and the Green Lights Programs through utilities in their purchasing practices.

Table 8-13. Type of California Utility Energy Efficiency Program

Type of Program	*Percent of complexes that have participated in utility programs*
Refrigerator rebate or change-out program	28%
Low-flow shower head	9%
Weather-stripping windows and doors	7%
SMUD	7%
Low-flush toilet	7%
Appliance rebate	4%
PG&E program	3%
Water heater tank insulation	3%
Water conservation	< 1%
Dishwasher recall	< 1%
Stoves dishwashers	< 1%
Air conditioner rebate turn in rebate program	< 1%
Green Lights	< 1%
Don’t remember	29%

9. SUMMARY AND CONCLUSIONS

In this volume we have presented and analyzed information pertaining to apartment complexes in California and the energy-using equipment for common areas of those complexes. Major conclusions are brought together in summary form in this chapter.

9.1 CHARACTERISTICS OF THE APARTMENT COMPLEXES

High proportions of apartment operators (86 percent) operate entirely within California. About half of these have business lines other than commercial apartments, most notably commercial real estate. The largest proportion of the complexes was built in the 1970s. The number of complexes built in the 1990s is about a fifth of those built in the 1970s. We attribute this to the severe decline in the economy in California in the early 1990s.

The average complex has about 100 units. The number of complexes varies by service territory, with SCE having larger complexes than either PG&E or SDG&E. Complexes built in the 1980s have more units than complexes in other decades. There is a preponderance of two bedroom units (46 percent) followed by one bedroom units (41 percent). Efficiency and three bedroom units represent eight and six percent of the total units.

Average monthly rents range from a low of $701 to a high of $1,057 in all complexes. Average rents are the highest in the SCE service territory. Average rent varies from a high of about $1.25 per square foot for the smallest units to $0.89 per square foot for the largest units. Average rents are lower in controlled complexes than in uncontrolled complexes.

The typical complex has an average of 3.2 staff. The typical staffing pattern in order of likelihood is a facility manager, a maintenance person, and a maintenance supervisor, and a leasing manager.

9.2 DECISION MAKERS AND DECISION MAKING

The person most often identified as the key decision maker for common area equipment requirements is the site manager. However, the decision maker varies depending on the characteristics of the apartment operator's organization.

From a programmatic perspective, site managers and owners are the primary targets with senior housing managers and maintenance supervisors are also important. For small companies that own their own properties with few and small complexes, owners should be the key target. For large management corporations with large sites and many complexes, the target should be senior housing managers. For corporations that own and manage large sites and large complexes, the target should be senior off-site housing

managers. Site managers are frequent targets but should especially be targeted when they represent a firm with smaller and fewer complexes.

Decision makers rate reliability as the most important decision criterion in purchasing equipment. Energy costs when the company pays for the energy, energy efficiency, and ease of maintenance were also rated as important. First cost is well down the list. In various studies we have completed in recent years, we have consistently found reliability to be ranked high. The reason for this is that the cost of servicing, maintaining, and replacing equipment often exceeds the cost of purchasing the equipment. From a programmatic perspective, programs need to focus more on the reliability and avoid recommending equipment and technologies with low reliability.

We reduced the original nine criteria using factor analysis to three sets of factors: an energy cost, energy efficiency, ease of maintenance factor, a one-for-one replacement factor and a first cost and prior experience factor. Different decision makers score differently on these factors. For example, maintenance staff score low on energy cost and efficiency and high on one-to-one replacement. Owners pay attention to energy cost and efficiency and less attention to first cost and prior experience.

In summary, we see that as the number of units at a complex increases and the total number of units a firm has increases, interest in energy costs and efficiency increases. We attribute this to the fact that larger firms may have more interest because of the total dollars involved and may have the staff and skills to monitor energy costs closely.

We also see that one-for-one replacement increases with the number of units in a complex, the number of complexes, and the total number of units that a firm has. We suspect that several things are going on here. Those with fewer units and fewer properties probably own properties that are less standard in layout and less standard with respect to how appliances are placed. This leads to nonstandard purchases. Also, replacement of equipment is episodic or infrequent which is likely to lead to buying what is available. In addition, because the number of purchases is low, there are unlikely to be standards or contracts from which equipment is purchased.

Finally, we see decreased price sensitivity and concern about prior experience and increased concern about ease of maintenance and reliability as the size of complexes, the number of complexes, and the total number of units increase. Concern about equipment price leads to the low cost choice, the low cost choice varies from week to week, and that means less standardization. Using prior experience reduces search costs. We should also keep in mind that prior experience can include much more than just prior experience with certain equipment, it may also mean prior experience with certain vendors. Finally, ease of maintenance and reliability may be more important for bigger operators because of the productivity implications. More change outs and more complex change outs over high numbers of properties and units may significantly increase costs. Thus, larger operators

are less sensitive to first cost and more sensitive to what it costs to change out equipment. For the large operators the costs are in the labor. For them, the less that has to be done and the more than can be done with lower cost personnel the better. Smaller operators may operate with a smaller number of maintenance persons who deal with the full range of issue and have broad skills. Because the volume of the work is less they may be more accepting of customized solutions.

Respondents rated six barriers to the use of energy efficient equipment. In general, respondents rated the barriers to be of slightly above average importance to above average importance. On average none of the barriers were rated as being "very important," that is, a 10. The highest average general rating of importance was 7.8 for reliability. The general rating of lack of capital was 5.2.

A factor analysis of the ratings suggests that the respondents do not really differentiate among the barriers. When we examined the barriers by the key characteristics of firms we found few statistically significant differences in the means. Indeed, there were so few statistically significant relationships that probabilistically, the significant correlations could have happened by chance. These data do not provide much support for the idea of dealing with barriers from a programmatic perspective.

9.3 USE OF ENERGY SERVICE COMPANIES

Third party developers offered products or service to 13 percent of the respondents in the California sample. About six percent had accepted the offer. Third party offerings were more successful when presented to owner operated firms than when presented to contract operated complexes. A key reason why offers were not accepted was that operators did not believe the savings claims.

9.4 ENERGY EFFICIENCY IMPROVEMENTS

About half of the operators claimed to have made energy efficiency improvements to their complexes. Most of these were for outdoor or indoor lighting. The median year claimed for these improvements was 1998 or later. With the exception of swimming pools, 83 percent or more of the respondents cited energy efficiency as the motivation for making the improvements. Reducing company operating cost was typically cited as a reason for making the changes half as often. Thus, more than half of those who are making changes are making them for reasons of energy efficiency but not for reducing operating cost. These differences are dramatic and suggest that many decision makers are electing energy efficiency for reasons other than cost.

From a program perspective, it is important to recognize that decision makers may not see the connection between energy efficiency and reducing energy costs. Another possibility is that the total cost of energy in a complex is not a very strong incentive to improve energy efficiency. The promotion of energy efficiency improvements may be more

successful if they are promoted for other reasons. It may be more effective to promote equipment changes for reasons such as safety, reliability and replacing poorly working equipment.

Program designers need to think creatively about ways to promote efficiency. For instance, programmers might look into the possibilities partnering with insurance companies to develop public area lighting safety programs. Program designers might want to implement programs built around predictive maintenance that would help to spot potential problems and lead to early changes of equipment. Program designers may want to promote equipment that is both efficient and reliable and stress the reduction in costs associated with the reliability. The energy cost incentive is much less attractive than other types of incentives.

9.5 UTILITY ENERGY EFFICIENCY PROGRAMS

About 16 percent of apartment operators said that they had participated in California Utility sponsored energy efficiency programs. Representatives of apartment managers indicated that they were more likely to have participated than owners were. Programs had been used more often in older complexes. Larger operators were more likely to have used programs than smaller ones.

We also asked respondents if they were planning to make changes in the next three years. About a quarter indicated that they were. The most common change that is anticipated is to renovate a complex or replace obsolete features. It is the larger firms that have plans to remodel. This potentially represents a significant opportunity to upgrade the efficiency of existing apartment dwellings.

Split incentives are often cited as a barrier to undertaking energy efficiency programs. Our analysis suggests that split incentives may only be a barrier in the area of water conservation but not for electricity and perhaps just a slight barrier in the gas arena.

9.6 TENANT UNIT EFFICIENCY

More than half of the operators buy appliances through pre-negotiated contracts. About 40 percent select and buy from available stock. The most common source of appliances is a local distributor or wholesaler followed by a manufacturer or a manufacturers distributor. Based on these data we believe that the best targets for programmatic action are the national manufacturers, major local wholesalers and distributors, and Sears, Best Buy and Circuit City well sell to small volume purchasers.

Once again respondents told us that reliability was the most important decision criterion. It was followed closely by energy costs when the company pays, energy efficiency and ease of maintenance. Other criteria were less important.

About 14 percent of apartment operators reported having participated in utility efficiency programs. The most frequently reported program was refrigerator rebates or change-out. Many complexes reported participation in water conservation programs.