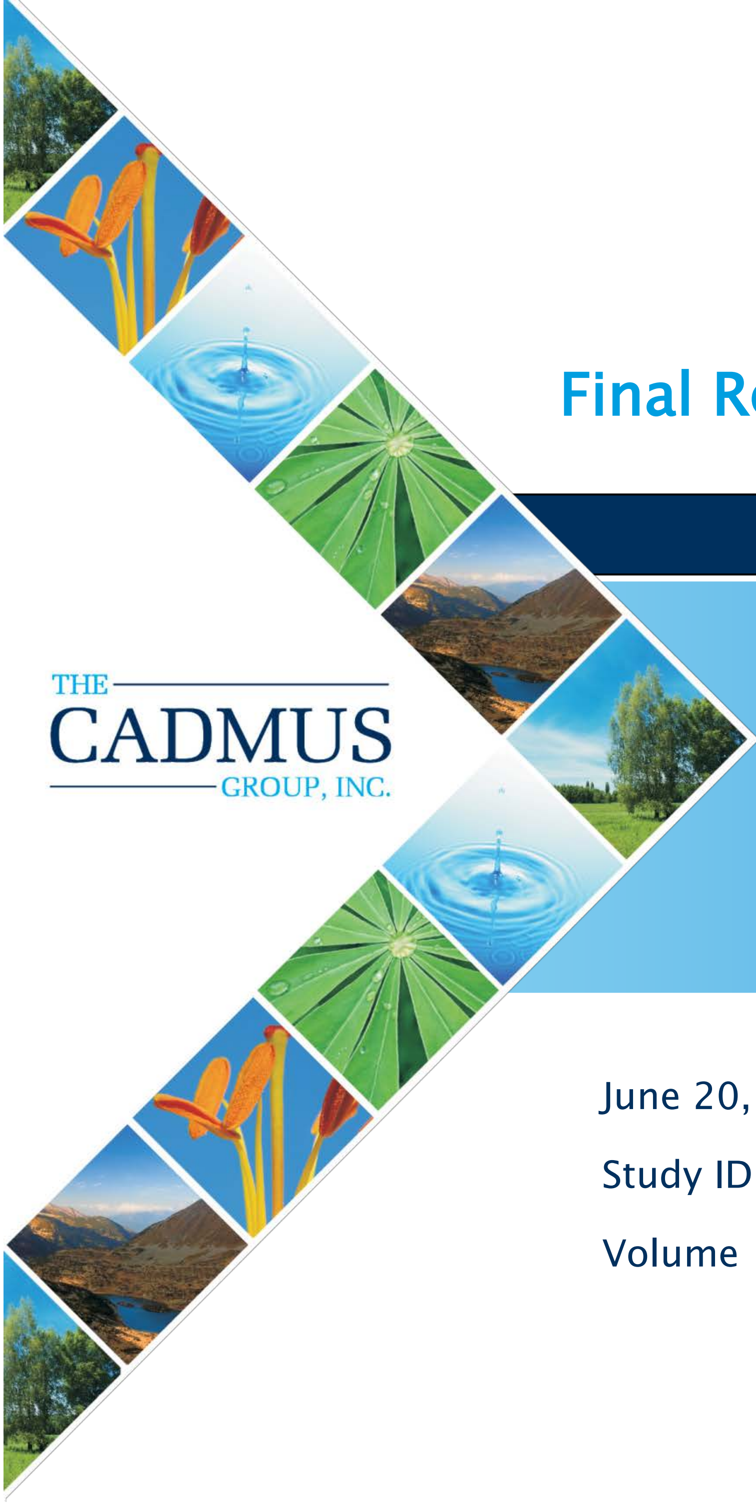

Final Report

THE CADMUS GROUP, INC.

Commercial Building Market Characterization for Savings by Design Program

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Table of Contents

1. Executive Summary 1

Background 1

Key Findings and Conclusions 1

Past Program Market Penetration 1

Factors Affecting Energy-Efficiency Decisions 2

Trends 4

Implications for Savings By Design Program and Savings Potential 4

Recommendations 6

Data and Analysis 7

Program Enhancements 7

2. Introduction 11

Program Overview 11

Study Overview 12

3. Program Market Penetration and Savings Potential 15

Program Market Penetration 15

Past Estimations of Market Penetration 15

Revised Methodology and Data Sources 16

Results 17

SBD Program Savings Potential 19

Past Estimates of Savings Potential 20

Cadmus' Methodology 20

Results 21

Analysis Limitations 37

Observations 38

4. Market Characterization 41

Objectives 41

Approach 42

Effect of Design Process, Ownership, Occupancy, and Building Type on Energy Efficiency 44

Drivers of Energy Efficiency 46

Effects of the Current Economic Downturn 47
Effect of Codes on Energy Efficiency 49
Influence of Green Certifications 49
Energy Efficiency in the Renovation Market 50

5. Commercial Building Market in SCE Service Area 55
Objectives 55
Approach...55
Interview Method 55
Interview Samples 56
Findings...57
New Construction and Renovation 58
Delivery Model Impact on Energy Efficiency 59
Occupant's Influence on Energy Efficiency 61
Market Trends Affecting Commercial Building Energy-Efficiency Programs 62
Recommendations by Interviewees 67

6. Market and Economic Trends 69
Objectives 69
Approach...69
Findings...69
Overview of Effect of Economic Downturn and Expectations 69
Economic Indicators and the Building Market 71
Population Trends 74
Industry and Employment Data 78
Implications for the SBD Program 81

7. Program Best Practices.. 83
Program Component Best Practices...83
Cross-cutting Topics and Themes...86
Linkages Among Programs 86
Non-energy Benefits 87
New Financing Approaches 87
Reporting, Tracking, and Metrics 88

Emerging Measures 89

8. Conclusions and Recommendations 91

Conclusions...91

SBD Program Market Penetration 91

Factors Affecting Energy-Efficiency Decisions 92

Trends 94

Implications for Savings By Design Program and Savings Potential 95

Recommendations...97

Data and Analysis 98

Program Enhancements 98

1. Executive Summary

Background

The Savings By Design Program (SBD or the Program) is a major Southern California Edison (SCE) energy-efficiency program targeting the nonresidential new construction market. SCE's effort is part of statewide implementation of the Program that began in 1999. The Program is designed to overcome customer and market barriers to designing and building high performance nonresidential buildings and facilities.

Several prior studies of SBD have been conducted examining market penetration, process issues, and Program impacts. In 2009, The Cadmus Group (Cadmus) began a study initially motivated to answer the two following research questions regarding the SBD market and market targeting:

1.) What is the market penetration rate (or market share) of the Program in the market sectors SCE has been very active in, how has market share changed over time, and is there further potential to grow the Program in these sectors or have they reached saturation?

2.) For those market sectors in which the Program has not been actively involved, which ones represent the best market potential for SCE to focus its resources on to recruit new Program participants and how should SCE identify approaches for penetrating these new market opportunities?

Prior studies addressing market penetration and market potential had been based primarily on analyses of quantitative data. Given the new challenges faced by the Program—a dramatic drop in construction activity and the changing face of the market and opportunities—our study built upon the prior research, but expanded the information sources to include market actor interviews and diverse market data to provide a richer characterization of the market in which SBD operates.

Key Findings and Conclusions

Past Program Market Penetration

Using a consistent metric—square footage of new floor space completions—we estimated the Program's market penetration for all building types and for categories of buildings. Table 1 shows that SBD has enrolled between 19% and 28% of the new floor space added each year from 2004 through 2008. As shown in Table 2, market penetration of the Program exceeded 20% for six categories of buildings over the period 2006 through 2008.

Table 1. Savings By Design Market Penetration

	2003	2004	2005	2006	2007	2008
Total Completions in SCE Territory (Adjusted) (1000 sq.ft.)	68,699	65,345	67,667	68,295	71,174	74,796
SCE Savings By Design Completions (1000 sq.ft.)	8,310	15,858	18,737	15,706	13,576	14,606
% Market Penetration	12%	24%	28%	23%	19%	20%

By building type, the penetration rate tends to fall into three groups: those buildings with low market penetration (4% or less); those with medium market penetration (11% to 17%); and those with a high rate (20% to 30%). Building types where penetration has been the least are mostly unusual types such as Amusement/Social/Recreational and Religious. The highest rates have been in Manufacturing Plants/Warehouses/Labs, Schools/Libraries/Labs, and Stores/Restaurants. The other categories with penetration rates over 20% are Government Service, Hotels/Motels, and Warehouses (non-manufacturer owned). Buildings in the mid range include Hospitals/Other Health Treatment and Office/Bank.

Table 2. SBD Market Penetration by Building Type, 2006-08

Building Type	%Market Penetration
Manufacturing Plants, Warehouses, Labs	29.4%
Schools, Libraries, and Labs (nonmfg)	28.4%
Stores and Restaurants	23.6%
Government Service Buildings	21.9%
Warehouses (excl. manufacturer owned)	20.7%
Hotels and Motels	20.4%
Miscellaneous Nonresidential Buildings*	20.5%
Hospitals and Other Health Treatment	16.9%
Office and Bank Buildings	11.2%
Amusement, Social and Recreational Bldgs	3.7%
Parking Garages and Automotive Services	1.2%
Religious Buildings	0.7%
All Buildings	20.5%

*Note: Value was set to overall average for all other building types due to missing floor area data.

Factors Affecting Energy-Efficiency Decisions

The major determinant of the energy efficiency of nonresidential new construction or renovation appears to be whether energy-efficiency goals are established by a key stakeholder early in the process. In general, the key stakeholder is the owner. However, other stakeholders, including the developer, architect, or O&M staff, can be very influential. In renovations, the facility manager or building engineer often push for energy-efficiency improvements.

Major factors that drive increases in energy efficiency in new nonresidential buildings (and renovations) include:

- Desire to reduce utility costs as a component of operating costs, particularly in the current market with higher vacancy rates
- Building energy codes (including the CALGreen code) and rating systems such as LEED—tighter codes, however, make it more challenging for programs like SBD to produce energy savings
- Sub-metering and tenant utility billing in multiple-tenant buildings so tenants have an incentive to reduce energy use
- Benefit-cost analyses based on energy modeling and economic analysis
- Desire to reduce greenhouse gas emissions
- Societal benefits and branding benefits

Key obstacles to investments in energy efficiency in nonresidential buildings include:

- Upfront costs, including energy modeling costs
- Capital constraints
- Lack of sub-metering in multiple tenant buildings
- More difficulty getting plans through review process

The evidence suggests that the energy efficiency of a nonresidential building is not very dependent on the process used to go from the concept phase through construction. Furthermore, whether a building is built based on a totally new design or a variation of a standardized design does not appear to be a significant determinant of its energy efficiency.

Building types identified as likely to be built to be more energy efficient include:

- Government sector buildings
- Academic facilities
- Data centers
- Large chain retail facilities

On the other side, those likely to emphasize energy efficiency the least include:

- Hospitality
- Small retail and malls
- Office buildings

The influence of the ultimate building occupants on the energy efficiency of a building varies. When a building is built for the owner to occupy, the chances are often good that the design will be energy efficient. When new facilities are “build-to-sell,” the energy efficiency is usually not a concern to the builder. Energy efficiency is often not a priority in buildings built to lease either because of the split incentive between owner and occupant and the situation depends on who pays the utility bills. However, tenants are increasingly asking for energy-efficient or green renovations.

Trends

The most significant trend affecting the nonresidential construction market in Southern California is in the drivers that influence the demand for commercial floor space. Population and employment trends drive the need for floor space. Recent projections show that the most growth in employment in Southern California will be as follows by sector, starting with the sector with the most jobs added:

- Trade/Transportation/Utilities~1.28%/year[1]
- Education Services/Health Care/Assistance~2.35%/year
- Professional/Business Services~1.68%/year
- Leisure/Hospitality~1.48%/year
- Local Government~1.23%/year

Consequently, the growth in new floor space will likely follow a similar pattern. In the near term, there is an expectation that growth in floor space will be the largest in the government, medical, and education sectors. Office space and retail space construction are expected to be very limited. Most analysts expect that overall nonresidential construction spending will begin to trend upward in 2011.

The confluence of these trends and the economic conditions suggests that much of the construction that does occur will involve renovations of existing buildings. Renovations projects with the potential for the highest energy savings are the larger, more complex projects. Significant drops in construction costs—as much as 30% to 40%—will provide some impetus for renovations. Increased concern about utility costs is another trend that has emerged from the economic downturn that will stimulate energy-efficiency investments.

Implications for Savings By Design Program and Savings Potential

The Program appears to have been most successful in enlisting larger organizations to participate, many of which also occupy the buildings they own, and these are the most likely candidates to invest in energy efficiency. Interviewees indicate that the administrative complexity of the Program has been an obstacle to participation by smaller firms. Given capital constraints it is probable that construction will shift toward smaller projects.

There are benefits of getting SBD involved earlier in projects, both new construction and renovations. It is possible to have more influence on the direction of a project through early involvement before substantial arrangements and decisions have been made. The challenge is finding ways to inform potential participants early enough about the Program, learn about future projects, and find points of entry. Again, SCE's SBD staff have recognized this need and taken steps to engage in projects earlier.

[1] Percent per year is the simple average of jobs added over 10 years based on a 10-year forecast.

The largest Program energy and demand savings historically have been in stores and restaurants, warehouses, and schools. Even though large savings potential remains in these building categories, recent and expected trends in the mix of building types suggest that the Program will need to target other building types as well. Both the relative and, in some cases, absolute potential savings in government service and healthcare-related buildings will increase as construction in the traditional segments declines.

Overall, the economic downturn has reduced the potential for Program energy savings. By 2011, additions to floor space are expected to decline significantly to just 32% of the 2008 quantity. An increase in construction is expected in 2012, but the overall level is expected to stay depressed below the 2008 quantity. The immediate challenge will be to maintain recent market penetration levels in the declining floor space additions.

Table 3 summarizes key information about the various sector building types and potential savings for each. The table presents the gap between the maximum potential savings (assuming all new construction has equivalent energy savings per square foot as recent SBD participants) and the base potential savings (assuming recent SBD square footage percent of new construction remains the same) over the period 2009 through 2012. The gap is a measure of how much Program savings could increase if the historical penetration rate increases to 100%. The gap percent (Gap %) is a measure of how large the gap is compared to the gap for the building type where the Program has had the largest penetration, i.e., penetration of 29% and a gap of 71% for Mfg. Plants/Warehouses/Labs. While Stores/Restaurants still have the largest potential for growth in terms of energy savings, Government Service, Warehouses (non-manufacturer owned), Schools/Libraries, and Hospitals/Other Health Treatment present very large potential savings too. The Gap % value is important because it indicates which building types have been underserved by the Program; building categories with values greater than the 28% average could be considered to be underserved.

Since the magnitude of potential savings and the Gap % are both important for purposes of targeting the Program, the table also presents a metric that combines the rank of each building type using both metrics, as shown in the last column. Based on these results, the best opportunities are in Hospitals/Other Health Treatment. They are followed closely by Stores/Restaurants, Government Service, Warehouses (non-manufacturer owned), and Parking Garages/Automotive Services, which are all tied using the combined rank. The rank of Parking Garages/Automotive Service is surprising; its rank results largely from the 96% Gap %, indicating that the potential in this category is largely untapped by the Program to date. Hotels/Motels and Manufacturing Plants/Warehouses/Labs are ranked lowest. Schools/Libraries/Labs unexpectedly are also ranked near the bottom because the historical penetration has been relatively high.

Table 3. Gap in Potential Savings, 2009-2012

Building Type	Gap, kW	Gap, kWh	Gap %	Combined Rank
Hospitals and Other Health Treatment	3,084	25,933,727	42%	1
Stores and Restaurants	15,691	66,796,228	20%	3.5
Government Service Buildings	3,949	50,205,212	25%	3.5
Warehouses (excl. manufacturer owned)	7,537	44,465,930	30%	3.5
Parking Garages and Automotive Services	733	6,656,479	96%	3.5
Office and Bank Buildings	2,230	12,236,483	62%	6.5
Amusement, Social and Recreational Bldgs	1,379	9,104,132	87%	6.5
Miscellaneous Nonresidential Buildings	1,834	15,969,181	30%	8.5
Religious Buildings	1,295	4,521,798	98%	8.5
Schools, Libraries, and Labs (nonmfg)	8,265	28,550,686	3%	10
Manufacturing Plants, Warehouses, Labs	2,656	16,179,887	0%	11
Hotels and Motels	994	3,649,266	31%	12
Total	49,647	284,269,009	28%	

Note: Combined Rank indicates rank when energy savings gap (kWh) and the Gap % ranks are combined with each weighted equally.

Considering the demand impacts, as well as energy savings, three of the best candidates based on the combined ranking—Hospital/Other Health Treatment, Government Service, and Parking Garages/Automotive—receive relatively low rankings in terms of their demand gap (kW). On the other hand, Schools/Libraries/Labs are rated low based on the combined ranking, but this category has the second largest demand savings gap. Consequently, if SCE is primarily seeking demand savings then the rankings could vary from those if energy savings are of paramount importance.

Finally, this study has produced evidence from many sources that major renovations are likely to represent a growing share of the opportunities for the Program. Insufficient information was available to analyze the potential for renovations, but the evidence is clear that renovations are filling a significant gap in the new building construction market and success of the SBD will be in part determined by its ability to target and recruit major renovation projects.

Recommendations

The findings from this study provide the basis for several recommendations that respond to SCE's needs to position SBD to maximize its effectiveness, especially in the face of the major market downturn that is occurring. Recommendations are presented in two groups. First, several analytic and data recommendations are identified that would support SCE's actions to ensure the continued success of the Program. Second, specific recommendations are provided for actions

SCE can take to improve the effectiveness of the Program, several of them relying on the analytic and data recommendations.

Data and Analysis

Obtain demographics and other market data and projections: Population and employment trends in Southern California will drive the market for new buildings and renovations. We recommend staying current with the California Employment Development Department statistics and forecasts to understand the drivers of the nonresidential building market.

Obtain essential market construction data: We recommend that SCE continue to obtain data on the number, type, and square footage of new additions to the building stock completed each year.

Obtain essential market renovations data: Given the current, and possibly future, growth in importance of this market activity it is essential for the success of the Program to quantify the size of this market and trends.

Perform market penetration analysis: The methodology we used to estimate Program market penetration relies on consistent data sets and analysis. The methodology should be expanded to include major renovations.

Conduct network analysis for the Southern California nonresidential building market: Information on market actors should be compiled and used in a network analysis to identify who the key players are and relationships among them.

Estimate Program market potential: The analysis e method applied in this study provides insights into the segments in which the Program has been most successful and opportunities for Program targeting that could increase effectiveness. With the addition of data on renovations and further analysis, similar estimates could be developed for major renovations.

Program Enhancements

Continue to find ways to introduce SBD earlier in the planning and design processes: For both new buildings and renovations, Program participation is likely to increase if Program intervention can occur earlier in the process. SCE has recognized this need and taken steps in the Program approach to move its involvement further upstream.

Leveraging the market actor network the Program has developed is a place to start. Other possibilities are working closely with local government entities that may know about coming projects, interfacing with private sector services (such as Reed or McGraw Hill) that track similar information, or expanding outreach to the building community.

Engage with local building and planning departments to maximize opportunities to increase energy efficiency and minimize barriers: One way the Program can influence the earliest stages in development is to work with local government entities responsible for planning. Informing local planning and building officials about the benefits of energy efficiency in new and existing buildings and tackling regulatory impediments can increase the ways in which energy efficiency can be increased through SBD. Similarly, the Program should work with both designers and building officials to facilitate the approval of possibly uncommon efficiency measures and equipment. This could help reduce review time or the probability of rejecting desirable measures.

Use information from this study to help target the Program to key building types: One way to select building types to target is to choose categories based on both the largest energy savings potential and the largest market penetration gap so far. The top five building type candidates applying this combined criterion are:

- Hospitals/Other Health Treatment
- Stores/Restaurants
- Government Service
- Warehouses (excluding manufacturer owned)
- Parking Garages/Automotive Services

If demand savings are a priority, then Schools/Libraries/Labs would be included in the priority categories.

Based on our analysis, the building types that would be the lowest priorities for future Program efforts are Hotels/Motels and Manufacturing Plants/Warehouses/Labs.

In new construction, target building owners: Because owners have the most influence on decision-making, the Program should step up efforts to market the Program to owners. The business case for increased energy efficiency needs to be made convincingly and early in the process.

Expand recruitment of major renovation projects: Though more difficult to identify than new construction, SBD Program staff should be able to get early information pending opportunities from components of the utility involved in economic development or from customer representatives.

Design and implement approaches to increase participation of leased space: For leased space, marketing to recruit participants should target not only owners, but also property managers, facility managers and building engineers, and real estate agents. Key elements in a program targeting tenants and their tenant improvements or major renovations should include:

- Encouraging sub-metering so tenants are aware of and pay their utility bills
- Providing incentives to invest in specified energy-efficient tenant improvements
- Linking to an SCE program for retrofits and interior improvements, so that the incentive can be designed to address both the owner and the lessee
- Containing specific educational components to address the special needs of tenants and provide state-of-the-art information about new technologies and interior treatments

Explore ways in which the Program can provide decision makers with credible energy savings and cost estimates: The Program should examine ways to cover the expenses of energy analyses or provide energy analysis services to potential participants.

Communicate the range of benefits of participating in SBD: Program materials, education, outreach, and interactions with potential participants should stress not only the energy savings, but the reduced operating costs over the life of the building or space; environmental benefits and sustainability; urgency of the need to reduce energy consumption; and the competitive advantages energy-efficient space offer in the market as businesses continue to look for ways to trim costs and become more environmentally conscious.

Continue to simplify the participation process for smaller projects and renovations: SCE has recognized the need to simplify the participation process and developed simpler tailored approaches. The success of these approaches should be evaluated and modified and expanded, as appropriate, to help increase participation.

Meet special needs of retail participants: Energy efficiency has the potential to conflict with the image retailers may perceive they need to project to lure customers. Excessive air conditioning, open doors, and high illumination are examples. The Program should focus on ways to provide an attractive “climate” using a variety of approaches that optimize “walk-in” traffic at the lowest marginal expenditure of energy.

Develop specific approaches to involve public sector buildings: The Program should recognize the special needs of the public sector, particularly given the likely near-term growth in this sector. Specific options include: technical assistance; access to state-of-the art energy-efficiency equipment, fixtures, and building management systems; and engineering help to integrate emerging new technologies into the development plans for new construction and recommissioning for major renovations. Creative approaches to provide financing for projects “off the budget” should be examined and it is important to understand the decision-making process and identify work with the decision-makers to influence participation in the Program.

Explore the range of new financing options and how they might complement the Program: Innovative financing mechanisms that could help overcome the funding barriers faced by potential participants should be investigated.

2. Introduction

Program Overview

The Savings By Design Program (SBD or the Program) is a major Southern California Edison (SCE) energy-efficiency program targeting the nonresidential new construction market.[2] SCE's effort is part of statewide implementation of the Program that began in 1999. The Program is designed to overcome customer and market barriers to designing and building high performance nonresidential buildings and facilities.

Several studies of SCE's Program and the statewide SBD have been conducted over the years including:

- *Savings By Design Market Assessment Study and Process Evaluation*, prepared by Heschong Mahone Group, Inc., May 19 2009 (cited as HMG 2009)
- *SCE Savings-by-Design Program Savings Potential 2006-2008*, prepared by Heschong Mahone Group, Inc., April 10, 2007 (cited as HMG 2007)
- *NRNC Market Characterization And Program Activities Tracking Report 2005*, prepared by Itron, Inc., July 2006 (cited as Itron 2006)

The last report was supplemented by additional data and analysis for 2007 provided by Itron (referred to as Itron 2009).[3] The Program has changed over time to meet changing needs and increase the Program's impacts. In the 2006-2008 Program cycle, significant Program changes included:

- Adding a new Program element to apply incentives to building design efforts only, rather than both design and construction efforts
- Targeting specific customer segments such as hospitals, clean rooms, and fast food

In the 2009-2011 cycle, the Program was modified to increase effectiveness. The changes included:

- Increasing the maximum incentive for whole-building projects
- Adding an incentive for peak demand reductions
- Offering a mass-market simplified approach for small projects
- Adding a set of sustainability incentives to promote additional steps to improve building design and performance.

[2] Participants in the Program are primarily commercial buildings, with only a few small industrial or manufacturing facilities participating. Consequently, we use the terms commercial and nonresidential interchangeably.

[3] This information was provided by Corina Jump, Itron, with a June 4, 2009, memorandum to SCE.

Study Overview

In 2009, The Cadmus Group (Cadmus) entered into a contract with SCE to conduct the present study. The study was initially motivated to answer the two following research questions regarding the SBD market and market targeting:

1.) What is the market penetration rate (or market share) of the Program in the market sectors SCE has been very active in, how has market share changed over time, and is there further potential to grow the Program in these sectors or have they reached saturation?

2.) For those market sectors in which the Program has not been actively involved, which ones represent the best market potential for SCE to focus its resources on to recruit new Program participants and how should SCE identify approaches for penetrating these new market opportunities?

Through discussions with SCE, the scope and focus of the study were modified beyond these research questions to provide SCE with a broader view of the market for the services delivered by SBD. Historically, participation had been largely categorized in terms of the types of buildings in the Program. However, SCE had observed that Program participation had been influenced by the relationship between the developer/owner and the eventual occupant and by the type of design process used in the project. A decision was reached to examine these market characteristics as a way to gain additional insights into the market to help program management identify the best opportunities to increase program participation in support of the California strategic plan energy-efficiency goals.[4]

The findings and recommendations from this study should be useful to SCE and SBD Program managers and implementers for monitoring Program effectiveness and providing strategic guidance to identify and make Program adjustments. Key ways in which the findings and recommendations benefit the Program include:

- *Providing a review of the Program's historical market penetration and current market penetration:* This analysis is the most accurate and consistent view of how market penetration has varied over time.
- *Providing a consistent basis for measuring and tracking Program success*: Market penetration can now be quantified on a consistent basis for the nonresidential construction market as a whole, and for segments of the market identified by major building/business types.
- *Providing an analytic method for assessing future opportunities and savings potential in the market*: This method will allow Program staff to estimate the magnitude of potential energy and demand savings to help shape targeting, outreach, and Program components.
- *Identifying major market drivers and trends, including the influence of the recession:* Fundamental demographic and firmographic drivers are identified and sources of

[4] California Public Utilities Commission. September 2008. *California Long Term Energy Efficiency Strategic Plan*.

information are presented that can be monitored and used in the future to examine market trends that would affect the Program.

- *Characterizing the energy-efficiency decision-making process for different owner and occupancy situations:* Insights about how energy-efficiency decisions are made and by whom, and what influences the decisions, are important for marketing the Program and developing strategies to affect decision making.
- *Identifying research that is needed to support the Program to allow continuous enhancements*
- *Identifying Program design and delivery approaches that will increase effectiveness and market penetration*
- *Identifying the importance of major renovations as possible Program participants and their unique characteristics:* The growth in major renovations is identified along with characteristics of this market that need to be taken into account for the Program to increase its market penetration.

Chapter 3 primarily responds to the two initial research questions listed above. It revisits the estimated Program market penetration rate over the period 2003 through 2008 using a consistent measure of market penetration. It also investigates the market potential for the Program using and expanding upon the same approach applied in prior studies, taking into account the dramatic market changes in the past three years. This study significantly improves upon the prior Program market penetration estimates in the following ways:[5]

- Market penetration is based on a consistent metric—completed floor area in the Program and in the market
- Market penetration estimates are developed by building type as well as for the complete nonresidential market
- Estimates for the market are derived from SCE service area zip-code level data rather than as a proportion of county data

Chapter 4 presents market characterization information based interviews with key market experts, including major developers, general contractors, property managers, and utility program implementers. Chapter 5 discusses the nonresidential building market in SCE's area based on interviews with market actors who participate in SBD and others who do not. Chapter 6 discusses major market and economic trends that are likely to influence the construction market, supported by a review of recent market literature, such as forecasts by McGraw-Hill and the AIA Consensus Construction Forecast Panel. This chapter also discusses effectiveness of the SBD Program. Chapter 7 summarizes information about best practices for nonresidential new construction energy-efficiency programs. Chapter 8 presents our major conclusions and recommendations. Throughout the report, key findings are highlighted

[5] Prior estimates were provided in various Market Characterization And Program Activities Tracking (MCPAT) reports and summarized in the Itron memorandum to SCE cited above.

Our original study plan included conducting a network analysis with the intent of identifying the key players in the Southern California nonresidential market. We obtained industry data that provided details on the nonresidential projects in this market over the past few years and conducted a preliminary analysis. Unfortunately, we found too many gaps in the data provided to establish a useful description of the network. We attempted to supplement the market actor information by asking interviewees for the other tasks about the key market players and developing a list to use in the network analysis. Although this produced some useful information, the responses were not adequate for conducting the network analysis. We believe this method could be useful to gain a fuller understanding of the Southern California market; however, it will require a more intensive data collection effort to compile the information needed for the network analysis.

3. Program Market Penetration and Savings Potential

This chapter provides the methodology and results used to answer the two initial research questions posed for this study addressing market penetration and savings potential. The market penetration rate analysis is discussed first, followed by the potential savings analysis.

Program Market Penetration

The objectives of the Program market penetration analysis include the following:

- Document how Program market penetration was calculated in the past
- Modify methodology to calculate penetration on a consistent basis using building completions data
- Obtain required data and estimate Program market penetration from 2003 through 2008 at the aggregate level and by building type

Past Estimations of Market Penetration

Market penetration for the SBD Program is defined as the floor area participating in the Program relative to floor area additions in the SCE service area. Although this definition seems straightforward, there are several variations in how it can be calculated. Prior to 2006, project savings (and, therefore, new floor area attributed to the Program) were claimed in the year that the project was initiated so the penetration rate was estimated based on floor area enrolled each year. Due to a ruling by the California Public Utilities Commission (CPUC), starting in 2006 all utility programs, including SBD, could claim project savings only as participating projects were completed.[6] For SBD participants, the time lag between the initiation (or permit) date and completion date could be substantial depending on the size and complexity of the project and how far along in the construction/planning process it was when it qualified for Saving By Design. In addition, some projects might never be completed or could drop out of the Program.

The methodology used in the past to estimate market penetration relied on Dodge Reports (described below), which were based on permits (assumed to be construction starts) for a given year, but not completions. The amount of floor area added in the SCE area was estimated based on permits issued in counties served by SCE. Until 2006, the penetration rate was based on estimated total building permits and Program starts. However, in response to the CPUC ruling described above, the Program penetration rate for 2007 was estimated based on SBD completions that year and building starts (permits issued).[7] While this aligned the SBD Program impacts with the year in which they actually first occurred, comparing SBD completions to nonresidential permits introduced an inconsistency in the penetration rate estimate because

[6] CPUC Decision 04-09-060, September 23, 2004, stated: “we clarify that only actual installations should be counted towards these goals, and not commitments. That means, for example, that the savings reported for PY2006 will reflect measures actually installed during calendar year 2006 (January through December), regardless of whether the commitments to install those measures were made in PY2006 or in prior program year(s).

[7] An estimate of the 2006 penetration rate was not provided in the prior analysis.

buildings were not typically permitted and completed in the same year. Table 4 shows the rates that were calculated in previous studies (Itron 2009).

Table 4. Prior Estimates of Program Market Penetration Rate

Program Year	Estimated Market Penetration Rate*
2000	14%
2001	41%
2002	36%
2003	41%
2004	43%
2005	73%
2006	--
2007	22%

*Rate calculation in 2007 switched from using SBD applications to completions.

After tripling between 2000 and 2001, the rate was fairly constant around 40% until 2005, when it increased to 73%. As noted above, the rate was not calculated in 2006, but in 2007 it dropped to 22% when based on the SBD completions in that year.

Another factor affecting the accuracy of these prior penetration rate estimates was the information used to determine which permitted buildings in the population were in the SCE service area. For the 2000 through 2005 analyses, a list of zip codes developed by various organizations was used to define the SCE service area.[8] A different approach was used for 2007. The permitted floor area in all the zip codes served by SCE was divided by the total permitted floor area in the counties served by SCE. This ratio was calculated for each year, 2000 through 2005, and the average of these ratios was multiplied by the total floor area permitted in the SCE counties in 2007. This provided an estimate of the floor area permitted in the zip codes served by SCE in 2007. This approach appears to be reasonable; however, as described later, when we requested a list of zip codes from SCE for our analysis, we found the list to be considerably larger than the list used in the prior studies.

Revised Methodology and Data Sources

To provide a more consistent and accurate estimate of market penetration, our objective was to compare *completions* of SBD projects to overall *completions* of nonresidential construction in the SCE service territory. Consequently, we needed to obtain annual estimates of floor area completed and an accurate list of zip codes served by SCE.

Dodge Reports from McGraw-Hill Construction is one of the two primary sources for construction data in the industry and were used in the prior SCE studies. The California Energy Commission (CEC) also uses Dodge Reports for their energy forecasts.[9] Usually Dodge Reports

[8] Personal communication, Corina Jump, Itron, June 24, 2010.

[9] The CEC makes modifications to the Dodge data to adapt the data for their forecasting process.

show new construction starts (permits) for a given year in total square feet of nonresidential construction. As described above, in the past these data were obtained for the 10 California counties in the SCE service territory and the subarea served by SCE (except for 2007). Since we wanted to compare completions, not permits, we requested that McGraw-Hill Construction provide estimated completions for a given year instead of permit data. Since the firm does not normally follow a project through the completion stage, this number must be estimated based on the number of months (or years) it takes to finish each type of project. The exact method that McGraw-Hill Construction uses to estimate completions was not described, but their estimates are probably the most accurate ones available and McGraw-Hill applies a consistent methodology to generate the completion estimates. We believe this is more of an apples-to-apples comparison than past estimates.

The Savings By Design program data were provided by SCE from their SBD Program database. However, the database did not report a consistent metric over the years for when a project was completed. For our analysis, we decided after discussions with SCE to determine the year when a project was completed using the incentive approval date. However, since that field was not populated until recently, it was necessary to calculate it for projects completed prior to 2007. For program years prior to 2007, projects were determined to be completed and assigned an incentive approval date if 1) they had “Completed (AP)” in the Detailed Status field and 2) had a date in the Redeem Date field. The redeem date was then used to assign a project to a given year as completed.

Results

Aggregate Results

A summary of the revised market penetration rate calculations for 2003 through 2008 is presented below. The total completions (in square feet) in the SCE territory were compiled from Dodge data for the zip codes served by SCE. The complete table showing the calculation can be found in Appendix A.

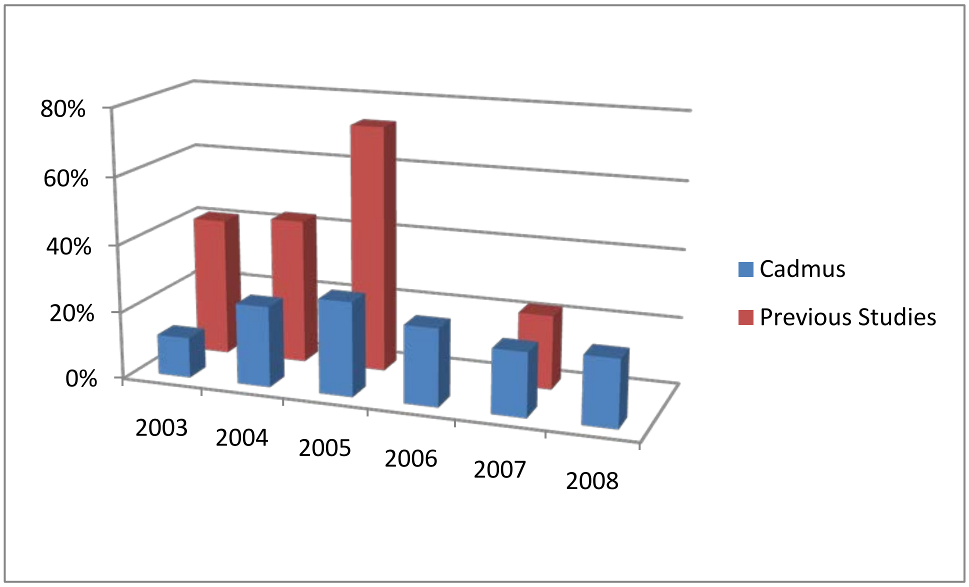
Table 5. Revised Estimated Savings By Design Market Penetration

	2003	2004	2005	2006	2007	2008
Total Completions in SCE Territory (Adjusted) (1000 sq.ft.)	68,699	65,345	67,667	68,295	71,174	74,796
SCE Savings By Design Completions (1000 sq.ft.)	8,310	15,858	18,737	15,706	13,576	14,606
% Market Penetration	12%	24%	28%	23%	19%	20%

For 2008, market penetration was calculated based on the 14.6 million sq.ft. of participating floor area from the SCE SBD database and the 74.8 million sq.ft. estimated by Dodge Reports for completions. Thus, for 2008 the estimated market penetration of the SBD Program was about 20% of the nonresidential new construction completed in the SCE service territory.

Figure 1 graphically illustrates how the market penetration rates calculated using the new methodology compare to the previous estimates (Itron 2009). As one can see, the new estimates are considerably less for 2003 through 2005. The results for 2003 are substantially lower, primarily because the estimated SBD completions are only about half the square feet shown for the remaining years. The fact that the earlier estimates are based on when projects were initiated appears to largely account for the previously higher penetration rates. The 2007 rate estimates are based on SBD project completions in both our analysis and the prior one. However, the penetration rate we estimate is higher than the rate calculated before because our method estimates the total market square feet using estimated completions rather than permits issued. Our analysis does show a decline in the penetration rate for 2007 (and 2008), but the decline is significantly less than appeared in the prior analysis that was based on inconsistent numbers.

Figure 1. Comparison of Prior Penetration Rate Estimates to Revised Estimates



Penetration Rate by Building Type

To examine how the Program penetration rate varied by building type, we calculated the ratio of the floor area of SBD participants to the area of all completions by building type over the period 2006 through 2008. The results are shown in Table 6. For all the buildings, the penetration rate is about 21%. The penetration rate exceeds the average for Manufacturing Plants/Warehouses/ Labs, Schools/Libraries/Labs, and Stores/Restaurants. The rate is significantly less for Religious Buildings, Parking Garages/Automotive Services, and Amusement/Social/Recreational Buildings. The penetration for Office/Bank Buildings is about 55% of the overall average and the rate for the remaining building categories is around 20%.

Table 6. Penetration Rates by Building Type, 2006-08

Building Type	% Market Penetration
Amusement, Social and Recreational Bldgs	3.7%
Government Service Buildings	21.9%
Hospitals and Other Health Treatment	16.9%
Hotels and Motels	20.4%
Manufacturing Plants, Warehouses, Labs	29.4%
Miscellaneous Nonresidential Buildings	20.5%*
Office and Bank Buildings	11.2%
Parking Garages and Automotive Services	1.2%
Religious Buildings	0.7%
Schools, Libraries, and Labs (nonmfg)	28.4%
Stores and Restaurants	23.6%
Warehouses (excl. manufacturer owned)	20.7%
All Buildings	20.5%

*The average of all other building types was used for this category because of differences in how the category was defined.

To assess whether the building categories with low penetration rates offer untapped savings potential, it is necessary to investigate both the savings per square foot and amount of square feet constructed by building type. This is discussed in the following section.

SBD Program Savings Potential

The steps carried out in the energy savings market potential analysis include:

- Review prior estimates of SBD savings potential
- Compare prior savings potential projections with actual results for 2006 through 2008
- Revise savings potential estimation methodology based on a consistent approach and data
- Based on actual market penetration by building type, determine whether there is further potential in sectors already emphasized by SBD
- Identify other building types that offer the best savings potential for SCE to focus its resources on

In the past, Savings By Design savings potential has been based on assessing the savings per square foot in various building types and comparing the floor area of participating projects to the total new floor area for each building type in SCE's territory. This study uses that basic approach, but relies on more consistent data and methodologies to address the research objectives above. This analysis is especially important now given the significant changes in recent years in the market for new nonresidential space.

Past Estimates of Savings Potential

The prior estimates of SBD savings potential were based on Program data for projects started and completed during the period 2002 through 2006 (HMG 2007, p. 3).[10] HMG estimated the average energy and demand savings per square foot by SCE building type. Using these values to estimate likely savings possible for each building type, HMG multiplied these values times the projected square feet of added floor space in the SCE territory using data from the CEC. They reported these results as the maximum potential savings, basically assuming that the maximum savings that could be achieved would be the amount possible if every new building had savings equivalent to the historical Program average per square foot. They then presented the results in several different ways to identify how effective SBD had been with different building types and where future opportunities were most likely.

The analysis showed that, under these assumptions, the largest potential energy (kWh) savings were in retail, grocery, warehouse, large office, and healthcare buildings. It also showed that the Program had already been quite effective in generating savings in grocery and warehouse building projects.

Cadmus' Methodology

Our methodology is similar enough for our results to be generally comparable with the previous estimates of Program savings potential, but there are some key differences in our approach. We decided to use McGraw Hill Construction Dodge statistics ("Dodge data") directly rather than CEC data, which are based on the Dodge data, because the data revisions made by the CEC are not readily transparent or repeatable. Additionally, the more complete and detailed Dodge data were required for other aspects of our analysis, so utilizing the same data purchase for multiple tasks was much more cost-effective. A more fundamental and important change was to use Dodge data estimates of nonresidential building square footage completions, rather than permits, as discussed before. This allowed us to conduct the potential analysis (and penetration analysis as previously described) on a basis consistent with completions under the SBD Program.

We reviewed the SBD Program database to determine historical savings per square foot by building type. The Dodge historical and projected nonresidential construction square footage data by building type were used to estimate the potential energy savings by building type. Unlike the prior analysis, we used the building types defined by the Dodge data to conduct our analysis. This was necessary because SCE was unable to provide actual building types for all their SBD projects. Many projects were identified by their NAICS code and it was necessary to manually review each of these projects and assign it to a building type.

The final step in our analysis involved adjusting Program savings by the actual market penetration rate (for historical Program savings) and by an estimated market penetration rate (for

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[10] Note that it was not totally clear in the report whether the Program square footage used was for completions in a given year or for the projects started in that year that were completed before 2007.

projected Program savings). Unlike previous studies, we used an average of recent historical Program market penetration rates (for 2006-08) as our estimated future market penetration, rather than taking the most recent year (which would have been 2008). This is likely to provide a more reliable estimate than relying on the penetration rate in a single year.

Results

Historical Savings by Building Type

The results in this section draw upon the market penetration numbers discussed in more detail in the market penetration section earlier. Once market penetration estimates were completed, the average kW and kWh historical energy savings were determined for each building category using the SBD Program database for 2003 through 2008 (see Table 7).

Table 7. 2003-08 SBD Normalized kW and kWh Savings

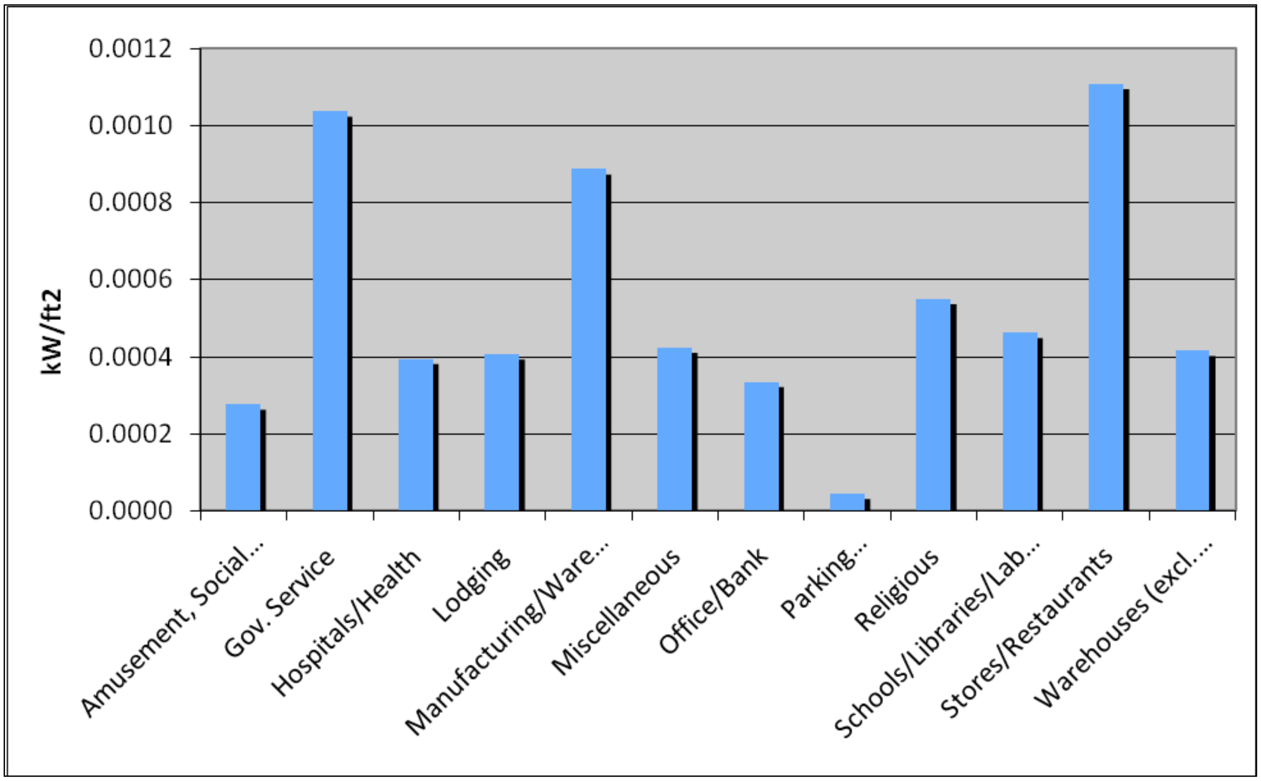
Building Type	Square Feet (ft^2)	kW	kW/ft^2	kWh	kWh/ft^2
Amusement, Social and Rec.	475,643	131	0.0003	863,303	1.8
Gov. Service	3,494,410	3,620	0.0010	46,027,812	13.2
Hospitals/Health	2,406,033	948	0.0004	7,971,999	3.3
Lodging	2,390,673	969	0.0004	3,558,585	1.5
Manufacturing/Warehouses/Labs	5,802,796	5,143	0.0009	31,330,673	5.4
Miscellaneous	7,725,823	3,268	0.0004	28,455,906	3.7
Office/Bank	6,006,093	2,009	0.0003	11,021,479	1.8
Parking Garages/Automotive	444,912	19	0.0000	174,377	0.4
Religious	550,967	303	0.0005	1,057,464	1.9
Schools/Libraries/Labs (nonmfg)	10,610,294	4,895	0.0005	16,908,125	1.6
Stores/Restaurants	16,761,428	18,564	0.0011	79,025,218	4.7
Warehouses (excl. manufacturer owned)	22,626,772	9,392	0.0004	55,411,489	2.4
Total or Average	79,295,844	49,261	0.0006	281,806,430	3.6

The building types with the most kW savings per ft^2 (see Figure 2) in the SBD Program from 2003 through 2008 were:

- Stores/Restaurants with average savings of 0.0011 kW/ft^2
- Government Service Buildings with average savings of .0010 kW/ft^2
- Manufacturing Plants/Warehouses/Labs with average savings of 0.0009 kW/ft^2

Parking Garages had the smallest demand savings per square foot.

Figure 2. SBD kW/ft^2 Program Savings

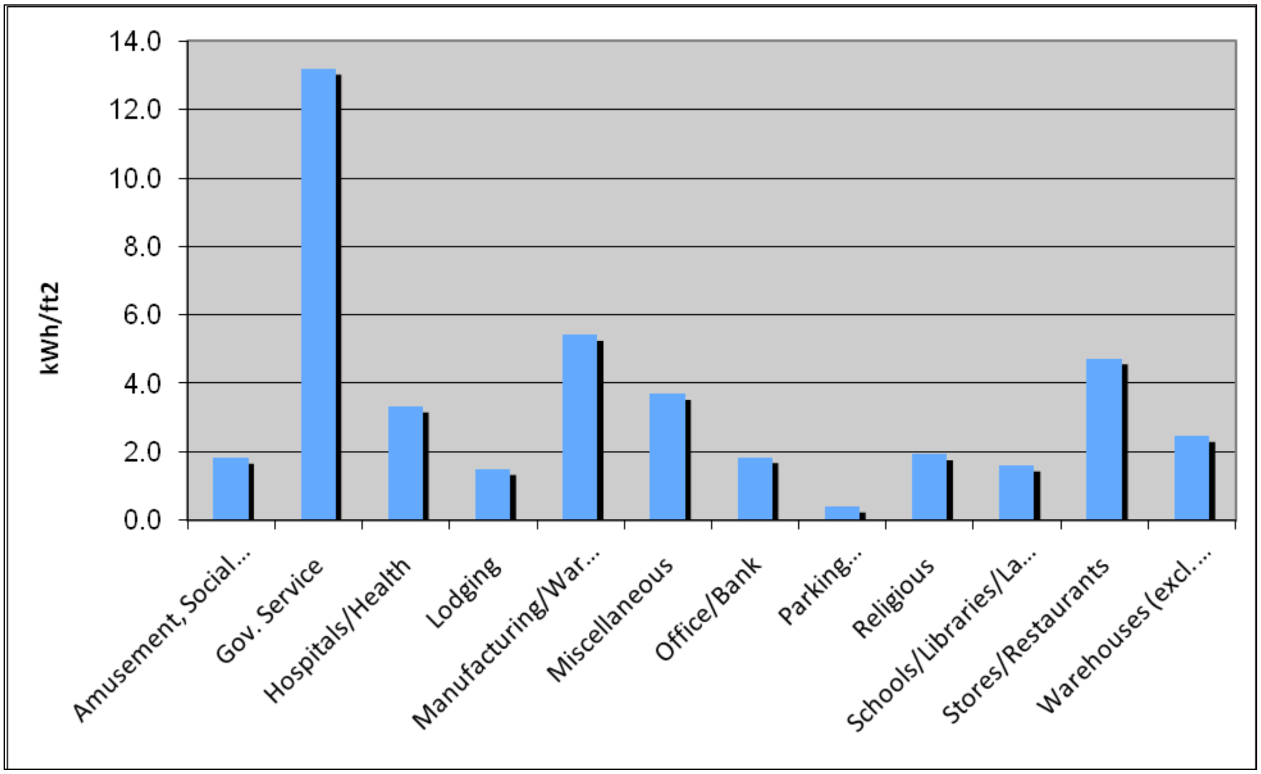


The building types with the most kWh savings per square foot were as follows (see Figure 3):

- Government Service Buildings with average savings of 13.2 kWh/ft^2
- Manufacturing Plants/Warehouses/Labs with average savings of 5.4 kWh/ft^2
- Stores/Restaurants with average savings of 4.7 kWh/ft^2

Parking Garages and Automotive Services again had the smallest savings at only 0.4 kWh/ft^2.

Figure 3. SBD kWh/ft^2 Program Savings



We compared our SBD savings per square foot estimates with those presented by HMG. The results of their study are shown below for comparison purposes. Our estimates differed from HMG's average savings per square foot, in part because HMG's study covered a different period, the Program years 2002 through 2006. A direct comparison by building type is difficult because of the differences in how buildings were categorized. However, for types that could be compared directly, our normalized savings were consistently higher. HMG's average kW savings per square foot came out to 0.0004, while we estimated average kW savings per square foot at 0.0006. HMG estimated average energy savings as 1.8 kWh per square foot, while we calculated average savings to be 3.6 kWh per square foot.

Table 8. HMG SBD Savings per Square Foot (2002-2006), by CEC Building Type[11]

Building Type	Square Feet (ft^2)	kW	kW/ft^2	kWh	kWh/ft^2
College	5,734,785	3,001	0.0005	10,616,448	1.9
Dormitory	N/A	N/A	N/A	N/A	N/A
Grocery	5,711,390	4,852	0.0008	34,459,899	6
Health Care	2,964,149	1,383	0.0005	12,548,579	4.2
Large Office	11,293,736	3,905	0.0003	11,513,817	1
Lodging	6,759,289	496	0.0001	2,530,808	0.4
Miscellaneous	6,368,418	1,806	0.0003	6,735,600	1.1
Restaurant	98,094	133	0.0014	101,794	1
Retail	14,996,510	13,048	0.0009	43,485,016	2.9
School	5,623,997	1,962	0.0003	3,229,090	0.6
Small Office	1,449,340	826	0.0006	1,061,813	0.7
Warehouse	45,608,231	12,272	0.0003	64,298,402	1.4
Total	106,607,939	43,684	0.0004	190,581,266	1.8

Projections of Savings by Building Type

Maximum Potential Savings

We used the kWh and kW savings per square foot estimated from historical data and the historical and projected additional square footage to estimate the maximum potential Program savings, assuming, as was done in the HMG study, that the Program could achieve 100% market penetration. The data Cadmus used were actual floor area additions through 2008 and projections for the subsequent years (see Appendix B).

As shown in Table 9, from 2006 through 2008 total potential Program kW savings were highest in Stores/Restaurants, followed by Warehouses, with Schools/Libraries/Labs also contributing significantly to savings. Over the same period (see Table 10), total potential kWh savings were largest for Stores/Restaurants, followed by Warehouses, and (small) Manufacturing Plants/Warehouses/Labs, with significant savings also in Office/Bank and Government Services buildings.

[11] This information and subsequent values from HMG are from HMG 2007.

Table 9. Maximum Potential kW Savings by Building Type*

Building Type	2006	2007	2008	2009	2010	2011	2012
Amusement, Social and Recreational	574	503	456	407	190	365	470
Government Service	674	912	1,042	984	723	1,572	1,778
Hospitals/ Health	932	1,078	1,406	1,108	1,076	818	711
Lodging	652	1,199	1,161	522	233	231	262
Manuf. Plants/ Warehouses/ Labs	2,773	1,600	3,982	1,543	982	498	738
Misc.	359	305	97	248	594	497	875
Office/ Bank	2,294	3,162	2,729	1,098	361	446	606
Parking/ Automotive	483	517	437	308	119	134	182
Religious	570	545	343	282	245	444	333
Schools/ Libraries/ Labs (nonmfg)	2,933	3,196	3,213	3,240	3,805	1,992	2,513
Stores/ Restaurants	12,967	11,064	14,124	10,438	2,622	2,994	4,485
Warehouses (excl. manuf. owned)	8,487	8,678	9,273	4,945	1,391	1,378	1,789
Total	33,698	32,759	38,263	25,122	12,340	11,369	14,742

*Estimates from 2009 on are based on projected floor areas

Table 10. Maximum Potential kWh Savings by Building Type*

Building Type	2006	2007	2008	2009	2010	2011	2012
Amusement, Social and Recreational	3,788,026	3,322,254	3,006,658	2,684,111	1,256,958	2,411,077	3,102,201
Government Service	8,564,989	11,595,698	13,245,998	12,506,136	9,189,730	19,986,819	22,603,537
Hospitals/ Health	7,837,070	9,064,960	11,818,807	9,312,433	9,045,974	6,876,699	5,979,282
Lodging	2,392,691	4,400,403	4,262,922	1,915,915	854,639	849,459	962,512
Manuf. Plants/ Warehouses/ Labs	16,890,866	9,747,999	24,257,640	9,401,638	5,979,709	3,035,667	4,494,109
Misc.	3,123,481	2,656,891	846,920	2,157,557	5,174,372	4,328,189	7,615,941
Office/ Bank	12,589,358	17,348,119	14,975,327	6,027,404	1,979,927	2,447,259	3,327,422
Parking/ Automotive	4,389,490	4,693,429	3,973,251	2,799,152	1,076,934	1,214,786	1,649,580
Religious	1,991,664	1,903,875	1,197,904	984,690	854,198	1,549,383	1,163,453
Schools/ Libraries/ Labs (nonmfg)	10,132,180	11,041,465	11,100,426	11,192,343	13,144,356	6,880,444	8,679,269
Stores/ Restaurants	55,200,400	47,096,573	60,126,137	44,432,057	11,163,011	12,743,287	19,092,488
Warehouses (excl. manuf. owned)	50,068,227	51,196,916	54,706,852	29,174,625	8,207,703	8,130,439	10,556,305
TOTAL NON RESIDENTIAL	176,968,442	174,068,583	203,518,841	132,588,060	67,927,511	70,453,507	89,226,100

*Estimates from 2009 on are based on projected floor areas

Figure 4 and Figure 5 display the same data graphically over an extended time period. Looking beyond 2008, the kW and kWh total savings potentials fall dramatically to about one-third or less of their 2008 values. This decline is driven by the projected drop in new floor space. The differences in construction trends by building type cause some significant changes in which building types have the largest savings potential. In 2011, Stores/Restaurants are estimated to provide the largest maximum potential demand savings, as in 2008, but the magnitude of potential savings declines by almost 80%. Maximum potential energy savings in these buildings also decline significantly in 2011. The large projected growth in Government Service buildings, plus their high level of kWh savings per square foot, leads to them having the largest maximum potential kWh savings in 2011 and 2012. Because their kW savings per square foot are relatively small, however, they rank only third in terms of potential demand savings in 2011. Schools/Libraries/Labs become the second largest potential source of kW Program savings in 2011 and an important energy savings (kWh) opportunity because their potential savings do not fall as dramatically as other building types. Warehouses also continue to offer significant energy and demand savings potential, although less so than prior to 2009.

Figure 4. Maximum Potential kW Savings, Historical and Projected

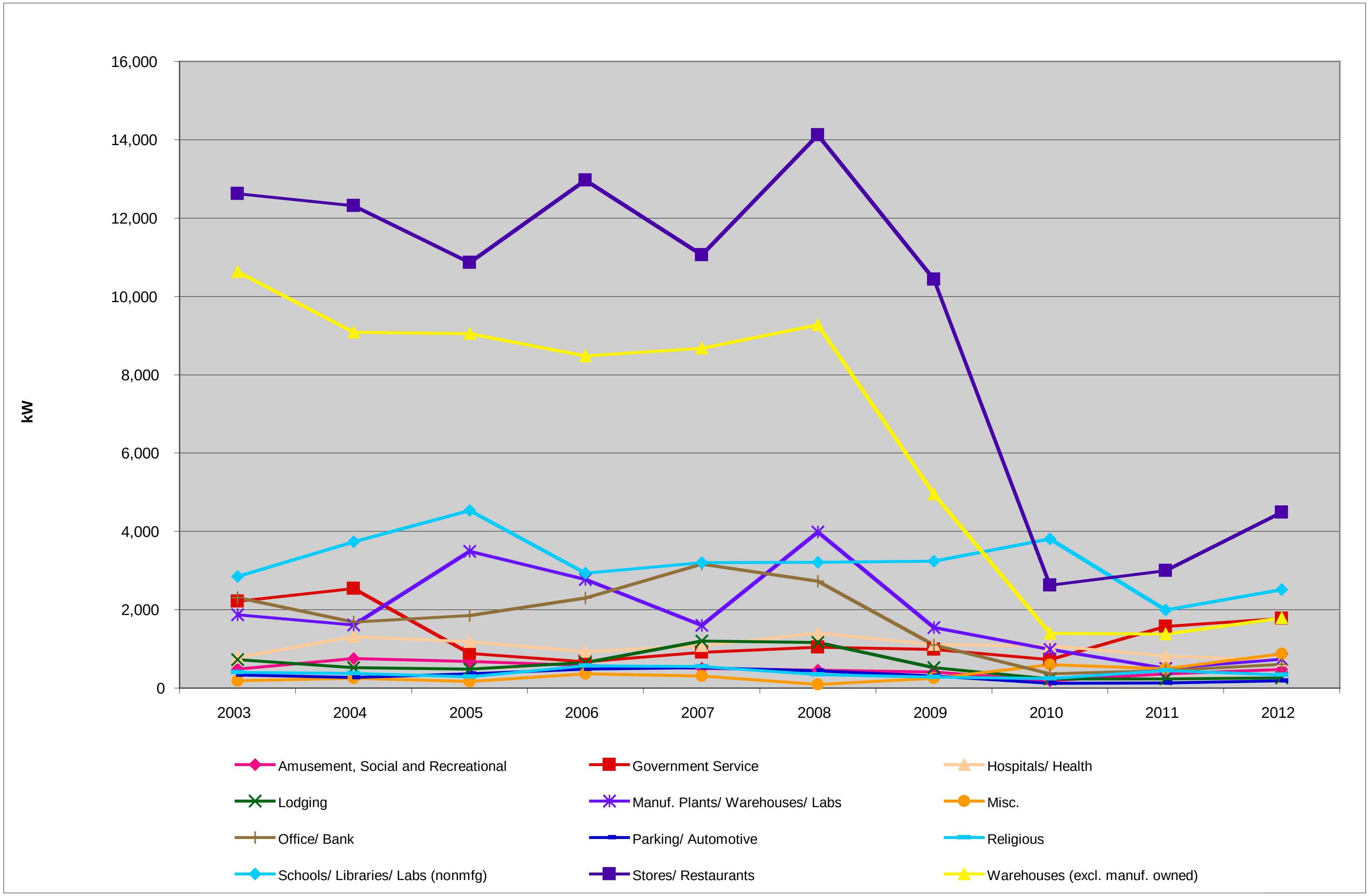
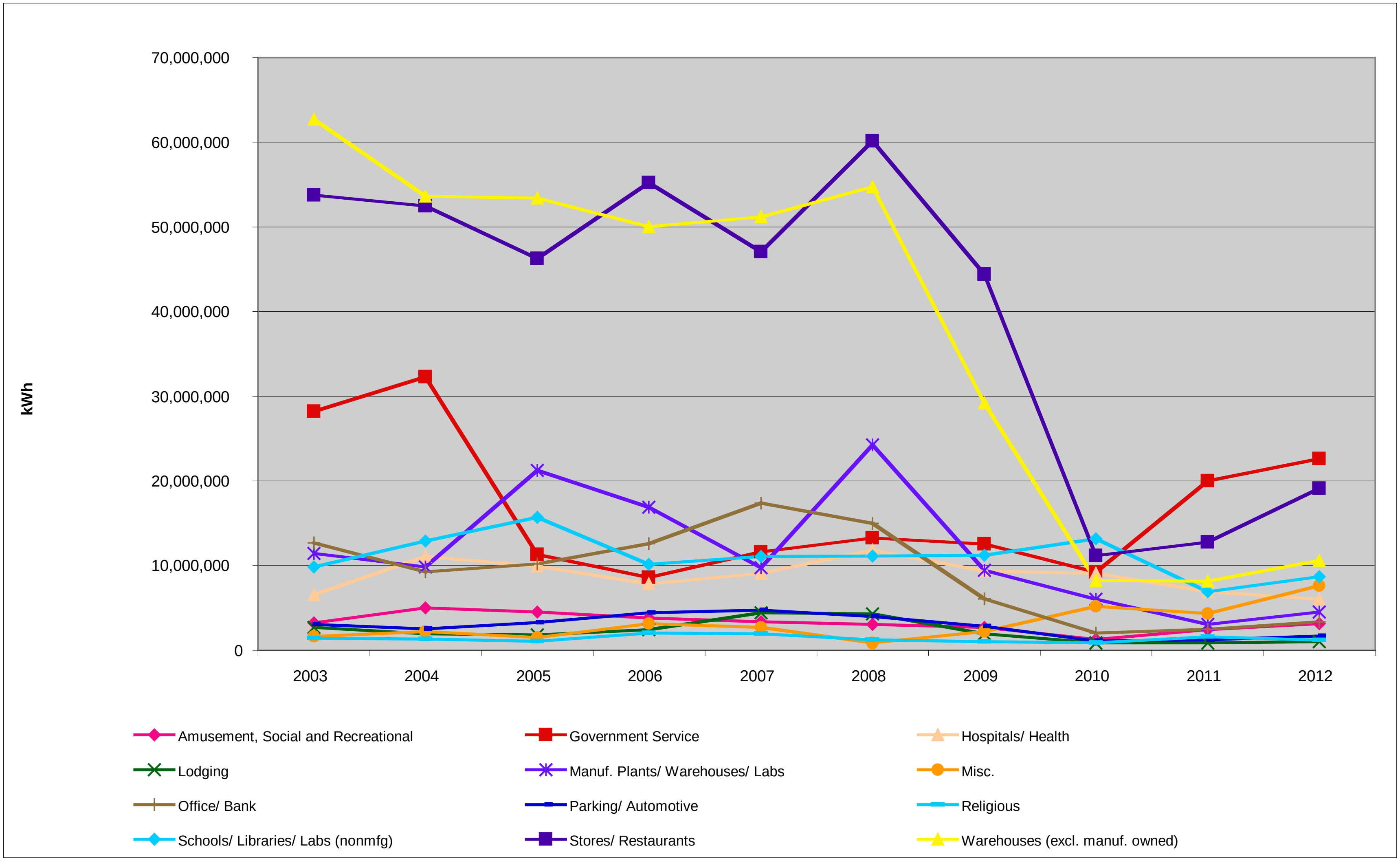


Figure 5. Maximum Potential kWh Savings, Historical and Projected



Comparison with Prior Maximum Potential Savings Estimates

The study conducted by HMG in 2007 used their estimates of savings per square foot by building type and projected floor space additions to estimate maximum potential savings for 2006 through 2008 as shown in Table 11 and Table 12. These results can be compared to our estimates in Table 9 and Table 10 based on actual data for that period. Their estimates of total potential demand savings are about 25% less than our estimates based on building completions in Table 9. This is largely due to their lower estimate of average potential demand savings per square foot (HMG's estimates are only about two-thirds of ours). Because the building taxonomy differs between our analysis and the HMG analysis it is difficult to make comparisons by building categories. However, lodging is a category common to both analyses. Our estimate of potential demand savings for lodging is between a factor of four and eight times larger than the HMG estimate; however, the estimated potential is relatively small in both cases. On the other hand, assuming that the HMG Grocery, Restaurant, and Retail categories can be combined into the Stores/Restaurants category we analyzed, the estimates of potential demand savings are almost identical for 2006 and 2007, and differ by less than 20% in 2008.

Table 11. HMG Maximum Gross Potential kW Savings, by CEC Building Type

Building Type	2006	2007	2008	2006-2008	% of 2006-2008 kW
College	729	692	698	2,119	3%
Grocery	2,125	2,047	2,080	6,252	8%
Health Care	1,048	964	1,114	3,126	4%
Large Office	4,252	4,359	4,610	13,221	17%
Lodging	157	142	142	441	1%
Miscellaneous	2,255	2,225	2,209	6,689	9%
Restaurant	2,454	2,426	2,494	7,374	9%
Retail	7,485	6,722	6,875	21,082	27%
School	1,362	1,322	1,262	3,946	5%
Small Office	1,972	2,002	2,086	6,060	8%
Warehouse	2,697	2,610	2,619	7,926	10%
Total	26,536	25,511	26,189	78,236	100%

Our estimate of maximum energy (kWh) savings potential based on completed floor area from 2006 through 2008 (see Table 10) is about twice the HMG estimate (Table 12). This is due largely to the higher kWh savings per square foot we estimate for the Program across most building types.

Table 12. HMG Maximum Gross Potential kWh Savings, by CEC Building Type

Building Type	2006	2007	2008	2006-2008	% of 2006-2008 kWh
College	2,578,772	2,447,334	2,467,699	7,493,805	3%
Grocery	15,095,911	14,540,831	14,770,105	44,406,847	16%
Health Care	9,508,322	8,742,067	10,109,476	28,359,865	10%
Large Office	12,536,632	12,851,653	13,591,802	38,980,087	14%
Lodging	800,883	724,127	725,999	2,251,009	1%
Miscellaneous	8,413,660	8,298,376	8,239,146	24,951,182	9%
Restaurant	1,879,309	1,858,555	1,910,442	5,648,306	2%
Retail	24,945,916	22,402,895	22,913,240	70,262,051	25%
School	2,242,105	2,175,503	2,076,748	6,494,356	2%
Small Office	2,534,127	2,572,223	2,679,918	7,786,268	3%
Warehouse	14,133,227	13,675,043	13,721,566	41,529,836	15%
Total	94,668,864	90,288,607	93,206,141	278,163,612	100%

The comparisons are shown graphically in Figure 6 and Figure 7. Figure 6 shows that our estimate of maximum kW savings potential is higher than the HMG estimates in all three years, with the largest difference in 20082006 and 2007 than the values we calculated, but our estimate is higher in 2008. As shown in Figure 7, our estimate of maximum potential kWh savings based on floor area completions is consistently higher than the previous estimates each year.

Figure 6. HMG and Cadmus Potential Maximum kW Savings Estimates

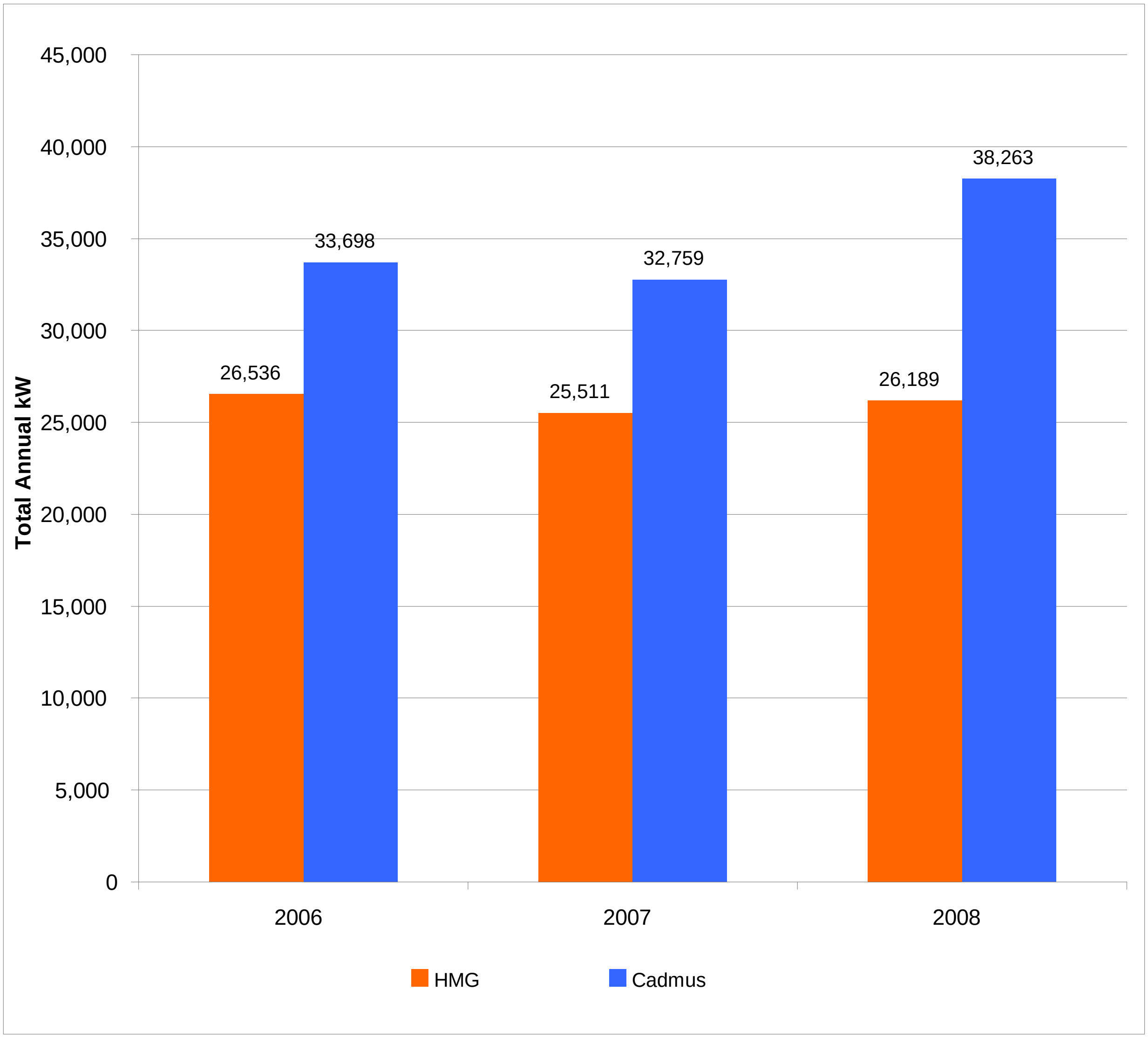
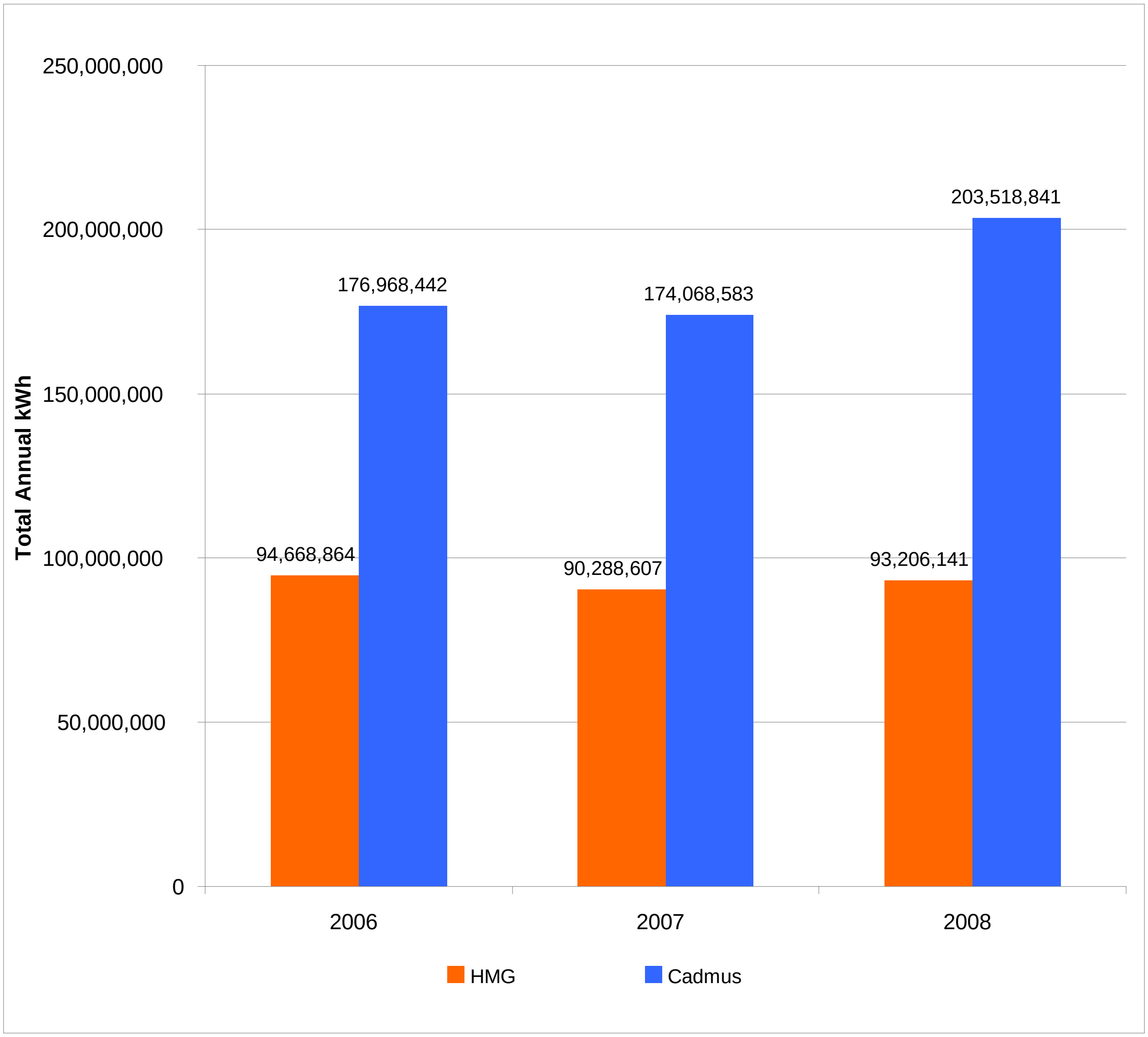


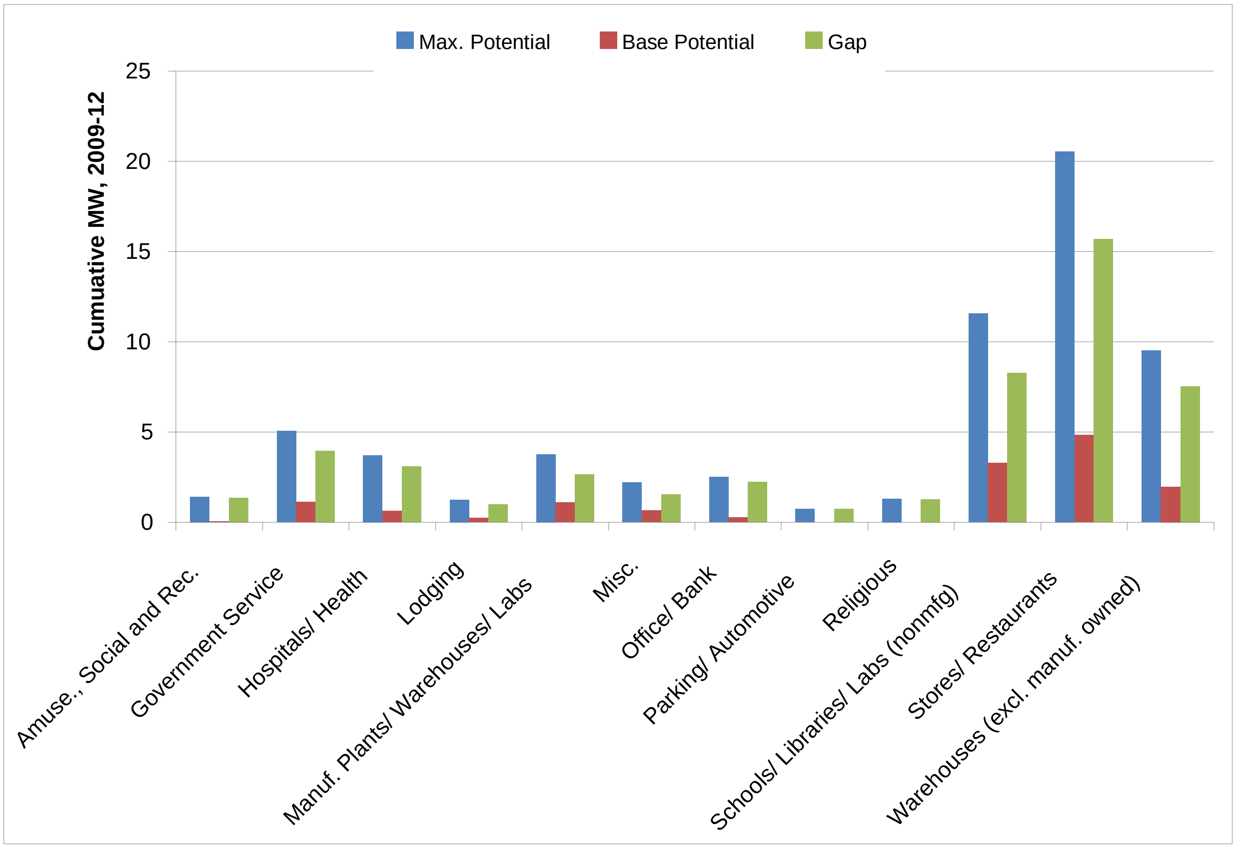
Figure 7. HMG and Cadmus Potential Maximum kWh Savings Estimates



To determine where the largest opportunities are in the near future for Program demand and energy savings, we adjusted the projected maximum potential savings by the SBD market penetration rate for each building type. The average of the penetration rates for 2006 through 2008 was used since these values are the most current and the average over this period smoothes out year-to-year variations.

Figure 8 shows the maximum potential demand savings, estimated over the period 2009 through 2012, and what we refer to as the *base potential demand savings* calculated using the average 2006-08 SBD penetration rate by building type. Figure 9 shows the same information for energy savings. The figures also display the gap between the two estimates. The gap gives an idea of the additional savings the Program could achieve, by building type, by exceeding the recent SBD penetration for that building type.

Figure 8. Maximum and Base Potential Demand Savings, 2009-12



By maintaining the recent market penetration rates, the largest base potential demand savings are likely to be achieved in Stores/Restaurants, followed by Schools/Libraries/Labs, and then Warehouses. The gap between maximum potential and base potential follows the same ranking. The figure also shows that the gap is very large for several building types relative to the maximum potential, including Amusement/Social/Recreational, Government Service, Hospitals/Other Health Treatment, and Office/ Bank Buildings. The same findings apply to energy savings as shown in Figure 9; however, Government Service and Hospital/Other Health Treatment stand out more significantly as opportunities than they do in terms of potential demand savings.

Figure 9. Maximum and Base Potential Energy Savings, 2009-12

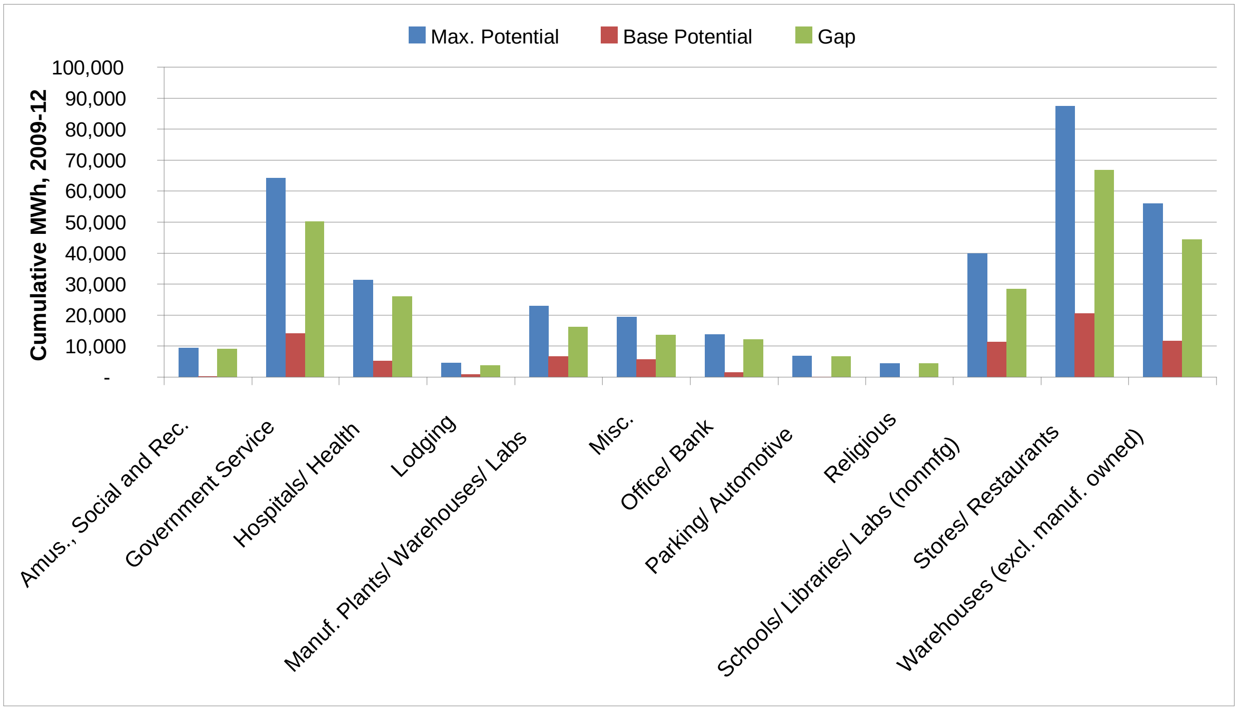


Table 13 further compares the distribution of demand and energy savings. For each building type, the table shows the percent of total maximum potential demand and energy savings in that building category compared to the percent of total base potential savings for the building type. For building types where the percent of total maximum potential exceeds the percent of total base potential, the building type may be considered to be underrepresented in the Program. The opposite is true of those building types where the base potential percent exceeds the maximum potential percent. The relationships in the table are similar for demand savings and energy savings. Higher savings have been achieved in Manufacturing Plants/Warehouses/Labs, Schools/Libraries/Labs, and Stores/Restaurants than the maximum potential distribution. The biggest shortfalls are in Amusement/Social/Recreational, Office/Bank, Hospitals/Other Health Treatment, Parking Garages/Automotive, and Religious buildings.

Though a direct comparison with the HMG report published in 2007 is not possible because of the different building categories analyzed, the basic conclusions are similar in most cases. That report found that the Program's recruitment of projects in office buildings and restaurants had been low compared to the potential for demand savings. The HMG report also found, on the other hand, that projects in warehouses had exceeded the proportion expected. In terms of energy savings, the HMG report found that kWh reduction efforts had been low relative to kWh savings potential in the health care, large office, and miscellaneous sectors. Our results generally agree with the HMG findings; however, the over representativeness of warehouses suggested in their study is not evident in our results, suggesting that the Program has managed to shift recruitment to other building types.

Table 13. Comparison of Savings Distribution by Building Type

Building Type	Demand Savings		Energy Savings	
	% of Max. Potential	% of Base Potential	% of Max. Potential	% of Base Potential
Amusement, Social, and Recreational Bldgs	2.3%	0.4%	2.6%	0.5%
Government Service Buildings	8.0%	7.9%	17.8%	18.4%
Hospitals and Other Health Treatment	5.8%	4.5%	8.7%	6.9%
Hotels and Motels	2.0%	1.8%	1.3%	1.2%
Manufacturing Plants, Warehouses, Labs	5.9%	7.9%	6.4%	8.8%
Miscellaneous Nonresidential Buildings	3.5%	3.2%	5.4%	5.2%
Office and Bank Buildings	4.0%	2.0%	3.8%	2.0%
Parking Garages and Automotive Services	1.2%	0.1%	1.9%	0.1%
Religious Buildings	2.1%	0.1%	1.3%	0.0%
Schools, Libraries, and Labs (nonmfg)	18.2%	23.5%	11.1%	14.8%
Stores and Restaurants	32.3%	34.8%	24.3%	26.9%
Warehouses (excl. manufacturer owned)	14.9%	14.0%	15.6%	15.2%
Total	100%	100%	100%	100%

Another way to view the effectiveness of the Program in reaching different buildings types is illustrated in Table 14. This table shows, for each building type, a normalized value, Gap %, based on the percent gap between the base potential savings (in kWh) and the maximum potential savings (in kWh). The values shown are calculated as follows:

$$Bldg\ Gap\ \%_i = \frac{Gap_i}{Max\ Potential_i}$$

$$Bldg\ Gap\ \%_{min} = \frac{Gap_{min}}{Max\ Potential_{min}}$$

$$Gap\ \%_i = (Bldg\ Gap\ \%_i - \ Bldg\ Gap\ \%_{min})/(1 - Bldg\ Gap\ \%_{min})$$

Where,
Bldg Gap $\%_i$ = Percent gap for each building type i
Gap_i = Difference between maximum potential savings and base potential savings for building type i, kWh
Max $Potential_i$ = Maximum potential savings for building type i, kWh
Bldg Gap $\%_{min}$ = Percent gap for building type with smallest percent gap

Gap_{min} = Difference between maximum potential savings and base potential savings for building type with smallest percent gap, kWh

Max $Potential_{min}$ = Maximum potential savings for building type with smallest percent gap, kWh

The overall simple average gap is 28%, indicating that 72% of the maximum potential savings from 2009 through 2012 are projected to be achieved if the Program performs as it has historically. The gap exceeds 90% for two building types, indicating the Program has far to go to reach the maximum potential in these categories. The building types with the smallest gap percent are Manufacturing Plants/Warehouses/Labs, Schools/ Libraries/ Labs, Stores/Restaurants, and Government Service Buildings. For these building categories, the gap between Program market penetration and the maximum potential is the least.

Table 14. Estimates of Savings Gap Percent

Building Type	Gap %
Amusement, Social, and Recreational Bldgs	87%
Government Service Buildings	25%
Hospitals and Other Health Treatment	42%
Hotels and Motels	31%
Manufacturing Plants, Warehouses, Labs	0%
Miscellaneous Nonresidential Buildings	30%
Office and Bank Buildings	62%
Parking Garages and Automotive Services	96%
Religious Buildings	98%
Schools, Libraries, and Labs (nonmfg)	3%
Stores and Restaurants	20%
Warehouses (excl. manufacturer owned)	30%
Overall Average	28%

Analysis Limitations

Our estimates are subject to a range of potential uncertainties. They rely heavily on Dodge data for estimates of building completions and projected completions. However, as long as the method to estimate completions is consistent, trends and relative changes should be sufficiently accurate. Clearly, the recent economic turmoil and the resulting downturn in nonresidential construction make it much more difficult to prepare accurate building activity projections, but this is a problem that affects almost all types of economic and market predictions currently.

Our projections are also subject to the uncertainties inherent in using historic energy savings by building type and market penetration rates as the basis for future estimates. Nevertheless, the historical record for energy savings should be a good indicator of future opportunities in similar buildings. Our Program penetration estimates based on consistent data show fairly stable results over several years, so an average rate is probably a reasonably accurate estimate of future rates in the next few years if the Program performs about as it has recently.

Observations

This research has developed consistent methodologies for estimating both SBD market penetration and potential energy and demand savings by building type. The methodologies rely on readily available data and can be updated on a regular basis.

Using our method based on building completions, Program penetration rates have not shown the dramatic swings observed in prior analyses. However, the overall rate for the Program has been generally lower than the prior estimates, but for the one year, 2007, when our analysis and the prior analysis both used SBD completions, our penetration rate was slightly higher (25% vs. 22%). The Program maintained a fairly constant penetration rate through 2008, the last year for which complete data were available in this study. How it performed in 2009 in absolute and relative terms will be important to determine. This was the first year in which the significant market-wide construction downturn had an impact, so it will be very informative to compare the Program completions with new nonresidential square footage added in 2009 to see whether SBD is maintaining market share.

Our analyses suggest that preserving Program savings may require a shift in direction. The SBD Program historically has had the largest amount of kW and kWh savings by enrolling stores and restaurants, which makes sense considering that stores and restaurants have the highest levels of kW savings per square foot and second highest kWh savings per square foot. Warehouses and schools have also contributed large savings historically. However, projections indicate that in the next few years the mix of new construction is likely to change and some of these shares will decline.

The biggest source of potential demand savings in 2012 is still projected to be stores and restaurants, but schools and libraries will become the next most important category, and government service buildings will be about as important as warehouses. By 2012, government service buildings will overtake stores/restaurants as the largest source of potential kWh savings. Government buildings already have by far the highest kWh SBD savings per square foot of any building type.

For some building types that have participated less in the SBD Program in the past the decline in construction is expected to be less severe than others or will even experience growth in the next few years. Key building types where the trend in maximum potential savings suggests additional Program focus would be appropriate include:

- Amusement/Social/Recreational
- Hospitals/Other Health Treatment
- Religious
- Government Service

4. Market Characterization

Objectives

The primary objective of this chapter is to present information broadly characterizing the commercial building market in terms of business or activity type (e.g., grocery store, large office, small office, warehouse, schools, etc.) in addition to exploring how commercial building design is influenced by the relationship between the owner/developer and building occupant. In the past, SBD market and potential analyses have relied on market segmentation based on business or activity type, but information on the relationships within the design and construction process and how they influenced energy efficiency were not addressed. Experience shows that certain categories of owners/developers and a specific minority of builders/developers are driven to build green, energy-efficient buildings. SCE, and prior research, have found that owners are the most influential drivers in the decision to build more energy-efficient buildings; consequently, examining the role of the owner in design and construction, and ultimate disposition, of a building is critical in understanding opportunities for increasing the energy efficiency of commercial buildings. For these reasons, the research conducted for this chapter examined building category subtypes and used project design and construction process and ownership typologies to reveal characteristics about the commercial building market that the SBD Program could take account of to increase program uptake, particularly in this period of significant retrenchment and shifts in the construction (and renovation) of nonresidential buildings.

In designing this study, the research team proposed investigating a taxonomy reflecting ownership/tenancy and the design/construction process. In reviewing the commercial building market, we developed three broad categories of ownership/tenancy relationships. In the course of this research, other variations were identified and investigated. The three basic categories we started with in this taxonomy are:

- *Architect-designed projects for owner-occupation (owner-financed, occupied).* These range from office buildings to laboratories, to university buildings and schools, to industrial facilities, and more. Most larger government projects *are* of this type, but most retail and much office square footage is *not* of this type. Overall this tends to be a fairly small market segment with the key to reaching it being getting buy-in from the owner.
- *Architect-designed projects for the lease market (not owner-occupied).* This category includes a lot of office space and most retail. It also includes large multi-family residential, to the extent that the project will not be occupied by the owner or its employees.
- *Design-build*. These projects are most often smaller (though not always), standard projects built to a formula by a small team of contractors where an outside architect is often not involved. They are either built to a single set of rigidly adhered-to specifications (such as franchise retail and food outlets) or to a formula that is altered slightly for each location or client (a lot of mixed use buildings – retail/office or retail/condo/townhouse – are this). This is more of a standardized way to build and meet code requirements, and produces a fairly generic product in the marketplace. These are sometimes speculative projects where the developer/builder has no incentive to invest to reduce the occupants' monthly bills.

The first two categories above usually fall into the "design-bid-build" contracting approach, as contrasted with the "design-build" approach. These options are discussed more in Chapter 5. The focus of the current chapter is on global market characterization with some discussion of the SCE area, whereas Chapter 5 concentrates on the characteristics of the Southern California market.

Approach

To develop an enhanced characterization of the commercial building market, we conducted two sets of interviews. The first was with utility program managers and the second was with a broader group of industry and market experts.

We started with interviews of primary utility staff members directly involved with the SBD Program, including one key manager from SCE, one from Sempra, and one from PG&E. From here, the evaluation team identified other utility programs similar to the SBD Program at the national level and reviewed their program specifications for similarities to identify those most comparable to the SBD Program. Three interviews were conducted with program staff for the non-California utility programs identified as being most like the SBD Program. These interviews focused on the characteristics of the market, in addition to building type, that are important for designing and implementing energy-efficiency programs, particularly in the current and evolving market. In addition, the interviews attempted to gain insights about opportunities to leverage other SCE programs (particularly technology programs) to enhance energy savings in the SBD Program.

As noted above, previous studies have relied on market segmentation based on business type such as healthcare, office, or retail. In addition to this basis, we framed our research questions by looking at who is making decisions regarding energy efficiency, and whether or not the way a project is delivered affects the efficiency level of the building.

After conducting the utility program staff interviews, the research team conducted interviews with a broader group of industry experts to provide a more global perspective and additional insights. Experts were selected either through referral or industry research, and several were pulled from the California Real Estate Education Association (CREEA) membership list. We also used a "snowball" strategy[12] to identify other industry experts by asking interviewees for referrals and suggestions. In all, 12 interviews were conducted with experts of various backgrounds within the commercial building market. An attempt was made to select experts with overarching industry knowledge instead of those solely with knowledge of an individual sector. We also sought out experts that have knowledge of both new construction and the renovation market, but a couple of the experts interviewed specialized or were knowledgeable in either one area or the other. The breakdown of market experts interviewed is shown in Table 15.

[12] A "snowball" approach refers to a process of asking interviewees to recommend other people to interview who can provide additional information and continuing this process with each interviewee.

Table 15: Number of Experts Interviewed by Type

Type of Expert	Number Interviewed
Property Manager	2
Building Industry Magazine Editor	1
Real Estate Department University Professor	2
Energy Efficiency Development Consultant	2
Developer	2
General Contractor	2
Architect/Design Firm	1
Total	12

Senior Cadmus staff conducted all interviews. Interviews with key utility contacts and experts were recorded to assure accuracy in reporting responses. The interview guides were based on answering questions in the following areas for the new construction and existing building renovation market:

- What is the relationship between ownership characteristics and building type?
- How do the design and construction processes vary by building type?
- What are the energy-efficiency characteristics and trends related to these additional characterization factors?
- What are the relationships between market characteristics and barriers to increased energy-efficiency?
- What are the unique characteristics of the renovation market?
- What are the options for increasing energy efficiency in leased buildings, including providing incentives to tenants moving into the space?
- What are the options for leveraging other SCE programs to increase SBD savings (as applicable)
- What are the unique features of the Southern California market? (as applicable)
- What are the likely effects of the current economic downturn and expected economic and other trends on the market characteristics?

The data from the interviews were used to characterize the market and develop key findings. We analyzed the information collected about the Southern California market to describe characteristics specific to SCE’s service area. Because the sample size was relatively small, the findings from this market characterization are indicative of the nature of the market and trends, but not statistically valid. However, the fact that there was good agreement among the respondents in several areas suggests that the interviews identified consensus views about some of the key market characteristics.

Interview Results

The interview results are presented below my major topic. Each section opens with a summary of the main findings. That is followed by more detailed findings from the interviews.

Effect of Design Process, Ownership, Occupancy, and Building Type on Energy Efficiency

Major findings on the effect of design process, ownership, occupancy, and building type on energy efficiency include:

- The relationship between ownership, tenancy, and the building type has a greater impact on a building's efficiency than how the design process was contracted (outside architect designed vs. design-build).
- Building type is not highly correlated with the ownership/tenancy relationship.
- Buildings that are most likely to build efficiently are: grocery, large regional or national retail, institutional (government, schools, and universities), warehouses, and class A office.
- Buildings that are least likely to build efficiently are: small retail, older multi-family buildings (retrofits/renovations), class C office, and hotels.
- An important distinction is that between "build-to-lease" or "build-to-sell" buildings since the latter category tends to be less efficiently built.
- Buildings built for the lease market, though, tend to be less efficient than buildings intended to be owner-occupied.
- Building occupants are usually more concerned with how their space meets their business needs than its energy efficiency.

The comments by utility staff and market experts were generally mixed with regard to the effect that the design process, ownership, and occupancy have on energy efficiency. In general, ownership and building type appear to have a greater impact on whether a building will be built to be energy efficient than whether or not the design was done separately from the beginning (as in the design-bid-build approach) or as part of a whole package such as in the design-build approach. There was no consensus on whether architect designed or design-build projects were likely to be more energy efficient and answers often conflicted.

The utility contacts interviewed were asked which building types generally fell into the three design, ownership, and tenancy categories defined above. It was reported that architect-designed buildings for owner occupation typically included grocery stores and small, less sophisticated schools. Architect-designed buildings for the lease market typically include Class A office and some retail. Design-build usually includes schools within large school districts, some hospitals, large retailers, warehouses, franchise retail, some government buildings, and large institutional buildings. Although many of these building types typically fall into these design, ownership, and tenancy categories, there is considerable variability.

There was some level of agreement, however, on both the occupant and building types that typically build most efficiently and those that are less likely to build energy efficiently. Building types that were cited as being most likely to be designed and built to be energy efficient included those in the following categories:

- Grocery
- Large regional or national retail
- Government
- Some schools
- Universities
- Warehouses
- Class A office

We anticipated that situations where the building occupants were also the owner or developer their interest in operating and energy costs could influence the design process to enhance energy efficiency. Our interviews supported this and we found most energy-efficient building is reported to be occurring most often in owner-occupied buildings in both the new construction and renovation markets.

When asked about building types that are least likely to build efficiently, retail was mentioned most often, especially lifestyle centers, small strip malls, and non-chain stores. Seven experts and three utility interviewees mentioned retail as being slow to adopt energy efficiency. Despite the recession, there is still some construction occurring in retail; however, energy efficiency in this sector is typically low. The exception to this is large or chain retailers (as noted above), especially at the regional or national level, who are becoming some of the top early adopters in energy efficiency. Other building types that were cited as lagging in energy efficiency were: older multi-family buildings (retrofits or renovations), class C office, and hotels. In these categories, small buildings and offices occupied by non-chain or franchise businesses are least likely to be energy efficient.

At the occupancy level, the lease market is typically less likely to build energy-efficient buildings. This is consistent in the market for both renovation and new construction. One interviewee pointed out that there are usually fewer decision makers for owner occupied buildings so it is easier to influence an owner to build efficiently. Several of the experts we interviewed noted that, even in cases where the builders focused on energy efficiency, the use of the building as perceived by the occupants may sometimes be at odds with the owners' energy efficiency objectives. The best example of this disconnect was a respondent's reference to an upscale mall whose retailers (occupants) ran their HVACs full tilt with their door wide open because it was a way to lure in customers.

In the course of conducting our interviews, it was recommended by one of the utility program contacts that buildings that would not be occupied by the builder or developer should be differentiated by whether they were for the "build-to-lease" or "build-to-sell" market. We found this to be a very useful distinction for differentiating the taxonomy further to understand the effect that the ownership/tenancy relationship has on energy efficiency. In some cases, buildings that are built to lease may be more efficient than ones that are built to sell or flip. This is mainly the case in buildings where the owner pays all or part of the utility costs and, therefore, is more concerned with energy efficiency than if they plan to sell the building and utility costs are not their responsibility.

The interviewees were in agreement though that leased buildings present barriers to energy-efficient operations and efficiency upgrades, and all but one of the experts indicated the reason for this lies in the lease structure and issues related to sub-metering. If the tenants split the utility bill or if spaces are sub-metered and paid for by the occupant, the owner will be less apt to care about efficiency because the cost is not their responsibility. On the other side, if the building is master-metered and the owner pays for utilities, the tenants do not have the motivation to be energy efficient. Energy-efficiency renovation is challenging in leased buildings too. One interviewee claimed that many energy-efficiency renovations that occur in leased buildings only include upgrades (typically lighting) to shared space and not individual tenant space due to the difficulty in renovating occupied space.

Drivers of Energy Efficiency

Major findings about drivers of energy efficiency in nonresidential buildings include:

- Owners are primarily motivated by cost savings and the competitive advantage achieved by being viewed as "green."
- Upfront costs can be a major deterrent to making a building energy efficient.
- Pursuing certifications such as LEED and ENERGY STAR is driven primarily by the marketing value added by creating an image of sustainability.
- Opinions vary on whether energy-efficient buildings can rent for a premium.
- Owners are the key decision-makers regarding making a building energy efficient, but other players, such as the property manager, building facility manager, or chief engineer, can have significant influence.
- Energy modeling can be very influential in convincing owners to invest in building energy efficiency.

The interview responses made it clear that the primary motives for owners in choosing to be energy efficient are cost savings and the competitive advantage that is achieved by being viewed as "green." Cost reduction through energy savings was cited as the single most important factor in becoming more energy efficient, followed by the advantage the "sustainable image" gives businesses. All interviewees were in agreement that cost savings is crucial in the decision to design and build energy-efficient buildings, but over half the respondents also pointed out that upfront costs can be a major deterrent. Certifications such as LEED and ENERGY STAR are significant motivators and building owners are moving in this direction so that they can be viewed as promoting sustainability. The image of sustainability has benefits from a marketing perspective for many businesses and was cited as the primary reason for a building to pursue LEED certification. Other influences include publicity and media coverage for sustainability and the drive to be sustainable because it is the "right thing to do."

Although less of a motivator for most businesses, some companies choose to be energy efficient and sustainable because they view it as their social responsibility and/or it is a core value of their company. The media attention to global warming and sustainability has encouraged this and many big-box retailers and national organizations are moving in this direction. Sustainability is becoming a core value for many major companies and, as one expert said, it is almost so common place that it is looked down upon in many industries not to have sustainable values in place. Although the extent that this view influences energy-efficient construction on a large scale is unclear, the value appears to be stronger in California than in other states.

There were mixed responses about whether or not green buildings could rent for premium prices. About 50% of the interviewees said that buildings built energy efficiently could rent for above market rates, while the other half disagreed and did not feel that the efficiency was a major influence. One interviewee pointed out that although it may not be possible to rent more efficient buildings for higher rates, the space is typically easier to lease out and less likely to remain vacant.

When it comes to the decision to build to be energy efficient or to install energy-efficient measures in retrofits, the owner is the primary decision maker. It is interesting to note, however, that although the final verdict is left to the owner, both the property manager and building facility manager or chief engineer have major influence on the owner's decision. Many large property management firms look for ways to improve efficiency in their properties and regularly make recommendations to building owners on what they should be doing to increase efficiency as well. This is common practice for the larger property management firms.

There are several factors that help convince the owner to make their building energy efficient. A big factor in the owner's decision is building energy modeling. Four of the experts cited energy modeling as an effective way to influence owners and were in agreement that the majority of owners do not understand the full extent of potential savings, program opportunities, and cost savings that can be achieved. Energy modeling is often what is needed to convince owners to make efficiency changes by educating the owner on the long-term financial benefits and the upfront cost effectiveness after making adjustments for rebates, and showing how energy efficiency affects the bottom line. One builder said that his firm pushes for there to be a collaborative approach between the owner, contractor, and architect early in the design process to share ideas. He said that it is much easier to get the buy-in needed to build energy efficiently if all of these key players are in agreement early on.

One of the property managers said that tenants at times ask for sustainable renovations in renewing their lease and said that although less common, tenants can also be an influence in making efficient renovations and retrofits in leased space. Onsite facility managers are also crucial to the decision making because they understand the biggest efficiency issues that affect their building.

Effects of the Current Economic Downturn

There was a consensus across interviewees that construction starts in the commercial market are currently very low, as Chapter 3 shows and subsequent chapters reiterate. The experts generally said that the construction market has been especially affected in office space and retail, where very little building is occurring. The large amount of vacant space makes it difficult to secure financing for new construction so many builders and owners are turning to renovations. Even in the renovation market, there has to be a justifiable economic reason to build for a project to even be considered. Although this is the case, all of the California IOU SBD staff interviewed said that Program participation is still high. One utility staff member pointed out that their total number of projects has increased significantly, but that the size of the projects has decreased and, in turn, so have potential energy savings. The interviews indicate that, although building still occurs outside these sectors to a lesser degree, building is concentrated in several major types:[13]

- Government
- Hospitals
- Institutions
- Schools
- Specialty buildings

In response to the economic conditions, owners are trying to lower energy costs by establishing energy-use baselines and determining what low- to no-cost improvements they can make to increase efficiency. They are making efforts to reduce energy costs through behavioral changes (e.g., turning off lights, shutting down computers when not in use, setting the heating setpoint lower, etc.) and through building efficiency maintenance (checking for gaps in insulation, changing equipment settings, verifying equipment is working properly and efficiently, etc.). One of the property managers interviewed claimed that doing this initial assessment and making these types of changes typically results in 5% to 15% energy savings. Once this has been done, then they may look into installing new measures and systems to further increase efficiency, but it is very hard to justify costly changes in these economic times. The economic downturn has increased awareness of the impact energy has on the bottom line. One interviewee said that this is more motivation for energy efficiency for the purpose of cost reduction and claimed that more money will be spent on energy efficiency wherever companies are able to.

- **Implications for SBD**: Potential participants are likely to be more receptive now to information on reduced utility costs that could result from energy-efficiency increases.

Perceived upfront costs are a major deterrent to making buildings energy efficient. For smaller projects, oftentimes owners will choose not to build efficiently due to their perception of what the upfront cost will be including the extra money required to do energy modeling. The cost of energy modeling can be a deterrent in itself for many owners.

- **Implications for SBD:** Participation is likely to be increased by explicitly providing incentives for energy modeling or the modeling itself and effectively communicating the energy savings predicted by modeling.

In the past, owners did not pay much attention to energy efficiency in “build-to-sell” construction because sales occurred relatively quickly so energy costs did not have a major impact on the owner. With much of this space standing vacant and unable to be sold, there are

[13] These observations compare well with the projected floor area additions for these building types used in the analysis presented in Chapter 3. These building types are among those for which the smallest decline in construction, or even an increase, is projected through 2012.

now new opportunities for energy-efficiency programs in the renovation market. One expert explained that most of these owners have great interest in lowering their operating costs to reduce losses due to vacancy. Little capital is available to make these changes so many of these owners are looking for ways to reduce upfront costs, such as utility rebate programs. This source claimed that owners now have more patience to deal with the time program involvement takes due to the huge pressure to lower costs.

- **Implications for SBD:** Major renovations are likely to be a significant opportunity area, particularly in vacant buildings, especially "build-to-sell" ones.

Effect of Codes on Energy Efficiency

There was a general consensus among all utility program staff and experts interviewed that the building codes create a push toward energy efficiency. Both at the state and national level, building codes are becoming increasingly more stringent. Compared to other states, California sets a higher bar for conservation and this causes the industry to increase their efficiency practices beyond local codes in the building they do in other states as well.

Two of our interviewees pointed out that the California Green Building Standards (CALGreen code) will make it easier to pursue LEED certification since this standard already meets many of the LEED requirements. In addition, one expert said that when the new regulations take effect, early adopters are going to be looking for ways to perform above code. It is important to note, however, that all experts we interviewed tended to be energy-efficiency leaders and it is likely that their views are not shared by the entire industry. Two utility program interviewees pointed out that, although they feel energy-efficiency codes are an effective way to increase efficiency in the market, the more stringent the regulations become the more difficult and expensive it is to build above code. They felt this could greatly reduce opportunities for SBD and other utility programs.

Influence of Green Certifications

The expert and utility program interviewees had similar responses in regard to the influence of different building certifications. In all, roughly one-third of the experts stated that ENERGY STAR is becoming commonplace and that many builders are choosing to benchmark their buildings. LEED, however, is slower to catch on, but is more highly regarded. Although the experts we spoke with all embrace and promote energy-efficient building, only one out of the four expert interviewees who were in the position to participate in LEED has participated. Those who had not participated in LEED projects were generally not aware or were only vaguely aware of LEED and its opportunities.

The most common barrier to participating in LEED is the incremental cost associated with the requirements. The two consultants that spoke specifically about certification agreed that the majority of buildings pursuing LEED push for Silver certification and that Gold is also seen at times, but more rarely. Platinum is seldom pursued and one consultant explained that Platinum certification is typically reserved for firms with sustainability as one of their core drivers, which are typically organizations involved directly in sustainability industries or non-profits. Many businesses do not pursue LEED Platinum due to the high additional costs, the long pay-back periods, and lack of full cost recovery. One LEED consultant explained that it typically costs 3% to 5% more to become Gold certified than it does to become Silver certified and that it typically costs 10% more to pursue Platinum certification. Two of the experts pointed out that the total number of projects pursuing LEED certification may not appear to be increasing due to the reduced number of buildings in construction, but when the percent pursuing LEED is compared to the total number of projects being built, the percent of projects choosing to become LEED certified is on the rise. Another expert stated that the cost to ENERGY STAR benchmark a building averages out to approximately $2,000 extra, so it is much less costly than LEED. As mentioned in the previous section, LEED certification could increase at a higher rate due to California's new CALGreen code since the requirements mandate buildings to follow many of the LEED qualifications anyways.

Energy Efficiency in the Renovation Market

This study highlighted the increasing importance of renovations as an opportunity for energy-efficiency enhancements in nonresidential buildings. Key findings relevant to SBD about energy efficiency in the renovation market include:

- Renovations have become increasingly more common in the commercial market as new construction has declined, businesses have been less willing to invest in new buildings, and vacant space has increased.
- Renovations offer a good opportunity to make efficiency upgrades and many utility commercial building programs are adjusting their efforts to fit the renovation market.
- Overall, savings for energy-efficient renovations tend to be low due to renovation budget constraints. The larger, more complex renovation projects have the greatest savings potential.
- A significant challenge with renovations is finding out about and getting involved in the project early enough.
- Property managers and real estate agents may be an effective means for programs to reach this market.
- Building facility managers and building engineers could also be good targets for efficiency programs to recruit the renovations market.
- The lack of sub-metering in leased buildings, and varied lease structures, presents obstacles to increasing energy efficiency through renovations.
- Upfront costs associated with energy efficiency in renovations are a major concern and anything that can be done by utility programs to reduce the amount paid up front will increase willingness to improve efficiency and participate in the program.

Renovations are a growing share of construction activity as new building construction declines dramatically. All experts and utilities interviewed agreed that renovation will play a bigger part in the commercial building market in the coming years. All but one of the utility program staff interviewed said they were seeing a greater number of renovations in their program since the downturn of the economy, and most are adjusting their focus to better fit this market.

Because energy costs for organizations can be a large expense, businesses are looking at ways to reduce energy costs and opportunities and reasons for improving energy-efficiency during renovations are abundant. Many office buildings are over-engineered for non-energy reasons and are very inefficient when it comes to lighting, heating, cooling, and layout because they do not use resources as sparingly as they could. Consequently, more consideration is being given to energy-efficiency improvements during major renovations.

Although renovation projects are increasing in comparison to new construction, funding constraints still matter, and renovations will usually be limited to what are perceived to be the essentials. Our interviews found that many of the renovations occurring are smaller in size and on tight budgets so energy savings are usually minimal. One interviewee pointed out that the renovation projects with the potential for the highest energy savings are the larger, more complex projects. Larger companies that have the potential for significant energy savings appear to be more likely to invest in renovations with larger savings, while a smaller company with limited access to upfront capital may not be able to justify the additional cost.

The renovation market requires a different program marketing approach than new construction. Some respondents suggested that the best way to reach this market is through property managers and commercial real estate agents. In renovations and retrofits, the building facility manager and building engineer typically push for energy efficiency and have a big influence on the owner's decision; however, these market actors are difficult to reach. Although renovations are occurring at a higher than usual rate compared to new construction, there are still barriers for programs to achieve energy savings through this market's participation in energy efficiency programs. It is much more difficult to get in at the design phase of these projects which, combined with cost, makes it harder to influence owners to install non-lighting measures. One utility is attempting to reach this market through commercial real estate agents that focus on concrete tilt-ups to advertise program opportunities to potential new lessees. This program manager also said that they get a lot of projects through their account executives for existing customers.

When asked about the kinds of efficiency measures being adopted in renovations, lighting is by far the most common, particularly compact fluorescent bulbs (CFLs) and induction lighting. LED lighting is slower to catch on due to the high price point. Although less frequently, variable frequency drives (VFDs) and HVAC replacements are also being seen in renovations and retrofits, but HVAC replacements typically do not occur unless equipment is near the end of its useful life. Other measures are also installed, but the interviews did not reveal any trends. Building owners are very focused on finding low cost ways to save energy and often smaller changes, like occupancy sensors, are being installed. Plug load efficiency is another area that is being explored more to reduce energy usage.

As mentioned before, there are difficult barriers to energy efficiency in leased space. The lack of sub-metering in leased buildings and varied lease structures make this a difficult area for energy efficiency. As noted, if the owner pays the utility bill the tenant has no incentive to be more efficient and, on the other side, if tenants pay their own utility bill, the owner does not have a cost-driven motive to increase efficiency. This issue was specifically identified by over 80% of the experts interviewed. One property manager claimed that a study conducted by their firm found that in about 70% of the cases tenants are not separately metered. This same study also looked at energy use in ENERGY STAR buildings and found that buildings where tenants were separately metered and responsible for utility costs used 20% less energy on average.[14] This demonstrated the potential for increasing efficiency in cases where tenants directly bear their energy costs.

The sub-metering barrier presents a challenge to increasing energy efficiency in the lease market. Before energy efficiency can become prominent in leased buildings, sub-meters need to be installed. Three experts proposed a solution to this issue, suggesting that it would be useful if the utility companies were to provide an incentive to help ease the cost associated with converting single-meter leased space into sub-metered space. These experts were in agreement that the potential for this market would not be fully realized until leased spaces became separately metered. Once this has occurred on a larger scale, energy-efficiency incentives directed at the tenancy level could be effective motivators, but until then they are not likely to be effective.

A major barrier to increasing energy efficiency in renovations is the upfront costs associated with energy-efficiency measures. Many owners do not fully realize the bottom line impact that energy savings can have in the years to come and that savings continue to occur even after the payback period. Even if the owner does realize the benefits, many simply do not have access to the amount of funds needed for an energy-efficient renovation in today's market. Experts were generally in agreement that anything that can be done at the utility program level to reduce the amount paid up front will increase willingness to improve efficiency. One option mentioned by three interviewees was to provide an incentive to pay for energy modeling. As noted earlier, this is the most useful tool for architects, builders, and consultants to be able to communicate full cost savings and benefits to the owner. One of the interviewees pointed out that once an owner sees the savings achievable after utility rebates and other reductions at the measure and whole building level, the chances of the owner choosing higher efficiency measures increases substantially.

Future Opportunities for Energy Efficiency in the Commercial Building Market

Multiple opportunities for energy efficiency in the commercial building market were recognized through this research task. As noted earlier, construction is likely to continue or expand for certain building types including government, hospitals, universities, prisons, data centers, and light industrial. Within the government sector, building types mentioned include schools, courthouses, and other public buildings. It was pointed out by one interviewee that many government buildings are required to build efficiently already. For schools, however, it was noted that many have a limited budget and typically will choose to spend funds on classroom space over increased energy efficiency. However, with the American Recovery and Reinvestment Act (ARRA, or Recovery Act) stimulus package, school construction and renovation will likely be more energy efficient, providing an opportunity for the SBD Program. Office space, however, has seen the sharpest construction decline and building is unlikely in this sector due to high vacancy rates.

Smaller building projects and renovations present an opportunity for energy efficiency. SCE is currently meeting the demand in the small building market through an online application to

[14] This was based on a proprietary study conducted by the source's organization and this individual could not share the data.

reduce the high administrative cost associated with including small projects in the Program. This appears to be an effective solution, and one other utility interviewed uses this approach as well. Although the renovation market presents opportunities, the barriers within this market make it a difficult area for the SBD Program to pursue. Even though savings opportunities exist and renovations are predicted to grow, the lack of sub-metered space makes this a challenging market for energy efficiency. Until sub-metering is more prominent, opportunities for the Program in leased space for renovations are limited.

One other barrier to increasing participation in small buildings and renovations is being able to effectively reach decision makers with Program marketing. For leased space, the interviews suggested that property managers, facility managers, building engineers, and real estate agents were likely to be effective channels for program recruitment so marketing tactics would have to be adjusted to target these market actors.

Within new construction, opportunities still exist for energy efficiency, but due to the economic downturn the number and size of these projects are in decline. The interviews affirmed our findings from literature and industry statistics that new construction has dropped considerably and has been slow to start to recover. As noted, the interviewees felt that builders were more likely to increase energy efficiency if they had completed energy modeling, though the cost of modeling was often a barrier. Interviewees pointed out the benefits of commissioning to demonstrate that once a building has been built it is actually operating at the planned level of efficiency. Interviewees suggested that incentives be offered to reduce the cost associated with commissioning to help ensure that the energy savings expected are actually being achieved.

5. Commercial Building Market in SCE Service Area

Objectives

The research for this chapter focused on providing actionable intelligence from a broad base of market actors including Program participants and nonparticipants. Based on the research agenda and issues identified in Chapter 4, the objectives of the interviews with SCE area market actors were to provide information on the following topics, primarily with regard to the Southern California market, and to compare perceptions and characteristics of Program participants to those of nonparticipants:

- How market actors in the area were adapting to current market conditions
- How the market distinctions defined in Chapter 4 affect energy-efficiency decisions
- What trends these market actors perceived as influential over the next five years
- What types of commercial buildings would be built over the next five years
- How much of future development would be new construction and how much would be major renovation work

The interviews conducted for this research task also produced data that provided insights related to the market trends discussed in Chapter 6.

Approach

Prior SBD process evaluations and commercial building market characterizations relied on historical market data and trends. The significant changes in the economy and building market in the last few years have undoubtedly reduced the reliability and validity of the findings from these prior studies. This current study provides a timely update on many of the issues covered in the prior studies by gathering substantive feedback from a diverse sample of market actors, including SBD participants and nonparticipants, and experts in the commercial building market. It also examines the commercial real estate development process in more detail to understand the interaction with energy-efficiency programs and to understand what actions SCE should take to improve the efficacy of the Savings By Design Program.

Interview Method

Although we followed an interview protocol, the interviews were designed to be flexible and relatively open-ended to permit exploring some topics in more depth and prompting respondents to provide useful insights. Key questions addressed by the interviews of both participants and nonparticipants covered the following topics:

- Building types they had constructed or participated in constructing
- Design/construction arrangements they engaged in
- Interest in energy efficiency and green building
- Perceived barriers to increasing energy efficiency and how these varied across sectors

- Energy efficiency and construction trends and their anticipated effects

Additional questions were addressed to the respondents to gather information about their perceptions of the SBD Program in the following areas:

- Awareness/knowledge of, and opinions about the Program
- Barriers to participating in the Program
- What program features and activities could increase participation, especially among market segments that SCE would like to target

Interview Samples

In selecting interview candidates from both SBD participants and nonparticipants, we found distinct differences in the composition of the sample frames. In both cases we made an effort to assure that the sample represented the characteristics of the two populations. Although the sample sizes were relatively small, we believe that the differences in the characteristics of the participants and nonparticipants interviewed were indicative of factors that led certain types of market actors to participate and others to not participate in the Program. These factors are described below.

Participants

Cadmus worked with SCE to identify owners, developers, builders, architects, and engineers that have participated in SBD. A sample frame of these market actors most recently participating in the Program was defined to capture the diversity of participating projects including building type, private and public sector ownership, green building practices, and design/construction processes. We interviewed 15 Program participants representing a cross-section of project characteristics.

The participants interviewed appeared to be representative of recent participants in the Program. The participant sample consisted of 93% owner/builders. The largest group of participants interviewed were the 36% from municipalities and schools; 29% were from large national chains; and 21% were with manufacturing companies. One of the participants interviewed was with a company that builds warehouse space both on contract for specific clients and also on a speculative basis.

Almost all the SBD participants we interviewed represented larger organizations that had project teams whose responsibilities included the initiation, management and tracking of the SBD application. Several of the builders were also the eventual occupants and most typically had multiple projects eligible for utility-sponsored energy-efficiency programs, whether located locally and involving SCE, or elsewhere in the state or country. These builders, whether public or private, recognized the benefits of harvesting the local energy-efficiency programs as a means of increasing their energy efficiency, but also leveraging any external sources of capital that might reduce their capital investment. One private sector participant, for example, said his firm managed a continuous stream of renovations and new building projects. Their energy-efficiency coordinator ensured that as many of the planned projects complied with the requirements of the SBD Program as was feasible. School districts too were cognizant of the Program as a means to defray some capital costs, and their facilities staff sought to include the SBD requirements and benefits into their engineering and financial plans. Larger companies with locations across the

United States also devoted staffing to ensure that such programs were identified and, where feasible, met incentive requirements. The commonality among these participants was the repeated exposure they had to the SBD Program (or others like it elsewhere) and the availability of specialized staffing to apply and track the requirements of the programs.

Participation by smaller commercial developers appears to be less, due in part to the uniqueness of the projects, which escalates the transaction costs, while also requiring a shorter payback period. Smaller builders also do not have the depth of staff to track the complexities of participating in such energy-efficiency programs across their geographic area.

Nonparticipants

We also identified a similar sample frame of nonparticipants. This group was developed with input from SCE based on their knowledge of market actors that had not participated in SBD. We also supplemented this list using information from the Dodge data and other sources such as contractor and industry publications. We interviewed nine nonparticipants in this group. Given the relatively small size of the nonparticipant sample, we note that the findings for this group should be considered indicative, but not necessarily representative of the population as a whole.

Most of the nonparticipants interviewed were either developers or contractors and planners that served the commercial building market. Many of them had been active developing commercial real estate for over 15 to 20 years, with some being active in the market for even longer. Some, but not all, of the nonparticipants maintained ownership of the developments they built, which were usually commercial centers leased to retail customers.

The sample of nonparticipants interviewed differed from the participants in several respects. For one, most, but not all, built or developed properties for others to own or sell. The builders usually handled a larger variety of projects for many types of developers or owners. This diversity of owners/developers resulted in a greater diversity of projects, which, in turn, meant that the builders could not as easily justify the staff resources to track and manage the SBD application and implementation. For this group, a concern mentioned by some respondents was that the paperwork and the difficulty in coordinating the work of the builder’s engineering team with the SBD requirements and technical team could be a barrier to participation. The lack of similarity or uniformity across their projects meant that the complexity and costs associated with the collaborative SBD process might make it not cost effective for these builders to participate. Finally, there was some evidence that the builders in the nonparticipant sample tended to build for clients who had their funding package already established, and participating in SBD was not desirable because it would be difficult to make adjustments to the financing arrangements among the stakeholders to take the incentive into account. This provided some additional evidence that SBD could increase its market penetration by becoming involved even earlier in the development process than it has been historically.

Findings

The findings from the interviews were reviewed and then grouped into major topic areas. They are presented here by topic area, starting with a general description of the topic. The findings from the participant and nonparticipant interviews are then discussed, and any distinctions in the findings from the two groups are identified.

New Construction and Renovation

Introduction

One of the questions that our survey sought to answer was whether there would be a significant shift in Southern California commercial real estate development over the next three to five years to reuse of existing structures, with new commercial construction substantially reduced by the oversupply of existing structures. The information presented in Chapter 4 (and later in Chapter 6) poses this as a likely macro trend and it was our belief that a significant inventory overhang of existing, but unoccupied, commercial buildings in the SCE service area would inhibit the construction of new facilities. Given the economies offered by adapting existing buildings rather than constructing new ones, we felt that it was highly likely that commercial property owners, builders, and developers would opt to engage in major renovations in preference to new construction.

"Major renovation" is defined in this study to consist of major changes to existing buildings including both comprehensive modernizations of the interior, redefining of the interior spaces, or exterior alterations where major components of the exterior envelope have been changed or altered significantly. Typical of a standard definition is the one provided by the Los Angeles Community College District in their 2002 Proposition A Bond Program brochure.[15] It defines major renovations as either being interior or exterior related projects, covering a minimum of 7,500 sq. ft. involving interior spaces, the exterior envelope, or a combination.

Findings and Recommendations

More than half the participants indicated that they were already engaged in renovations; another 20% were doing a small percentage of renovations. Most of the participants felt that this was a growing trend due to the inventory of underutilized buildings. They also expected this trend to continue for some time, due to the continuing weakness in the economy. A small percentage of the participants expressed even more pessimism and suggested that declining market conditions and increased vacancy rates would inhibit even the renovation market.

One participant commented that:

> "There is a lot of opportunity right now with retailers going out of business, there are lots of empty stores that can be retrofitted to meet new energy standards."

All the nonparticipant respondents directly involved in building indicated that renovations would be the predominant development activity over the next few years. One nonparticipating respondent summed up the situation as follows, "Currently, 40% of buildings in the area are vacant. If and when the economy improves, we will probably see more renovation of existing buildings." Energy-efficiency improvements would be relatively cost effective for these buildings according to a non-participating builder, "especially if the buildings are older. Electrical and AC are the easiest things to address. Tinted glazing is also an easy fix."

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[15] *Los Angeles Community College District Proposition A Bond Program Sustainable Building -Principles, Standards and Processes, Planning and Accreditation Committee Recommendations*. Prepared by DMJM/JGM, Proposition A Bond Program Managers. March 6, 2002.

All respondents, participants and nonparticipants alike, agreed that renovations were likely to be a dominant component of commercial space developments for the next several years.

Recommendations: These perceptions about trends in renovations as compared to new construction are consistent with the findings presented elsewhere in this report. Based on this information:

- *Savings By Design should continue to expand its focus on the renovation market.*

Delivery Model Impact on Energy Efficiency

Introduction

Another major question that this study sought to answer is whether the delivery model used to design and build the structures would affect the energy efficiency of commercial buildings. In Chapter 4 we defined two predominant delivery models.

To recap briefly, in the "design-bid-build" approach, the developer or owner engages an architect (or A&E firm) who draws up the plans. These are then disseminated for interested builders to submit bids on the construction of the project. In the "design-build" approach, developers or owners contract with a single entity that assumes responsibility for the architectural, engineering, and construction work.

Our interviews sought to test the hypothesis that the choice of delivery model affected the way energy-efficiency questions were addressed. In particular, we were interested in learning whether SBD participants and nonparticipants felt that buildings based on the sequential design-bid-build approach were inherently more or less energy efficient than buildings built under the design-build approach. We anticipated that one possibility might be that separating the design function from the build process might allow for more efficiency to be designed in up front. On the other hand, the design-build approach could lend itself to a more integrated process that better reflects the typically recommended integrated strategy for producing green and energy-efficient buildings. There is evidence that some major decision makers hold the latter view.[16] We sought through the interviews to determine which of these two hypotheses could be validated.

Findings and Recommendations

In the course of conducting our interviews, it became clear that the distinction between design-bid-build and design-build processes was not always clean and that one firm could engage in projects involving either approach or variations of them. Nevertheless, it was evident that the extent of design work done up front, as well as opportunities for making subsequent design changes, varied and these factors could influence the incorporation of energy efficiency in projects.

Our survey revealed that over 85% of the SBD participants engaged an architect or A&E firm up front to prepare designs on at least some of their projects, and many used them on all projects. However, this did not mean that plans were developed from scratch. In fact, half the participants

[16] "Lessons in a Design-Build Approach: The U.S. Department of Energy Leads the Way to Affordable Energy Efficient Designs," from http://www.aashe.org/blog/lessons-design-build-approach-us-department-energy-leads-way-affordable-energy-efficient-design , June 22, 2010

suggested that their plans were often adapted from prior plans, regardless of whether they used an A&E firm or a design-build firm. While some respondents said either the design-bid-build model or the design-build approach was usually utilized, many respondents used both approaches depending on the project. In some cases clients used the design capabilities of the builder, while in others they opted to bring in a separate architect. There appeared to be no clear distinction of when one method was used, or not. However, all the participants said that energy efficiency was becoming more important and was being addressed regardless of the delivery mode.

Through our surveys we also tried to affirm whether originally developed designs were intrinsically more energy efficient. The survey results were inconclusive. More than half the participating respondents (57%) did feel that original designs produced by architects were inherently more energy efficient. However, a significant minority (36%) disagreed, suggesting instead that cumulative improvements to standardized designs often made them more efficient. In the case of major renovations, most situations were unique so standardized designs were not feasible, but that did not mean that the renovation was likely to be more energy efficient. Whether renovations were energy efficient depended more on the objective of the developer/owner, and some had established standardized requirements for energy efficiency that were applied to their renovations, though the designs were each unique. For new construction, there was likely to be more of a tendency for energy efficiency to be considered in the case of new designs, but we found that standardized designs were often flexible enough to permit tailoring to the site and local conditions. Consequently, the builder, developer, or owner could increase the energy-efficiency requirements for what might be considered a relatively standardized design on a case-by-case basis.

Nonparticipants we interviewed all used A&E firms and, except for hotel construction, none said they used standardized plans. Nonparticipants' responses mirrored the lack of consensus among the participants on the question of whether standard designs were more or less energy efficient. Two-thirds felt that designs produced from "scratch" were more energy efficient, while another third felt that standard designs were usually inherently more energy efficient.

One notable barrier to the use of architect-designed plans in the current environment that we uncovered was the perception by developers that unique architect-produced designs were more difficult to get through the official approval process. Given the reduction in development plan review applications being processed by local jurisdictions, some respondents suggested that municipal development services staff were scrutinizing non-standard plans with greater thoroughness, often resulting in more questions and requested revisions. Standard plans, by contrast, could not be questioned as easily since there was a precedent for their acceptance, and thus they experienced fewer comments and delays.

We did not find that the building delivery model, whether using an architect separately or a design-build process, had much effect on the ultimate energy efficiency of the building. It appeared that the difference between these two approaches was often less clear-cut than the definitions suggest, and that energy-efficiency considerations were equally likely to be addressed in both instances. Basically, we concluded that there was not substantial evidence that the choice of delivery mode or how architects were involved affected energy efficiency in any predictable way. It appeared that energy efficiency was potentially as likely to be effectively integrated into a project regardless of the process; what really counted was whether energy-efficiency goals were introduced and strongly advocated by any of the active stakeholders (owner, developer, architect, builder, O&M staff) during the design process.

Recommendations: Based on the participant and nonparticipant interviews:

- *Given the widespread involvement of architects and A&E firms in new construction and renovations, the Program should expand its engagement with designers.*
- *SBD should work with the design community to explore ways to modify standardized designs to meet the Program requirements.*

Occupant's Influence on Energy Efficiency

Introduction

Another way to distinguish commercial real estate developments is to consider the relationship between the ultimate building occupants and the builder or developer. In Chapter 4 we identified the absence of an end-user's influence upon the design phase as a possible barrier to the introduction of more effective energy-efficiency measures. To examine this issue, in our interviews of Program participants and nonparticipants we sought to determine the extent to which the participation of prospective occupants in the design of commercial buildings had an influence upon the energy-efficiency characteristics of the building.

To provide more clarity on this issue we distinguished three types of relationships between the builder and the eventual building occupants: 1) builders/developers who owned the property and occupied the building; 2) builders/developers who would not occupy the building, but knew who would; and 3) builders/developers who did not know in advance who would occupy the building.

Findings

When asked whether the future occupants had some influence on the energy-efficiency characteristics of the building, the responses from both participants and nonparticipants were mixed. Given that the majority of the Program participants were owners/builders, it is not surprising that almost two-thirds felt that they had influence over the energy-efficiency aspects of the building design. But it is noteworthy that about one-third of the participating respondents declared that their personal influence was slight; this was often due to the separation of responsibilities within the organization. For example, statewide guidelines often dictate the design elements for the government and educational sector, leaving the eventual occupants only a limited opportunity to impact the design. We found that even when owners had a direct influence it was not always the actual occupants in the owner's organization who provided direct input on the energy-efficiency features of the building.

As noted above, nonparticipants interviewed were a more diverse group than the participants and most were builders or developers,but not as frequently the building owner or occupant. Nonparticipants, often building on a "speculative" basis for clients not yet identified, felt that their own construction energy-efficiency standards were sufficiently rigorous to accommodate the needs of the clients. The majority of these nonparticipants said they did not communicate directly with their prospective end-users during the design phase and, in general, their own standards superseded the needs of their retail customers. Most indicated that specific input on energy efficiency coming from the prospective tenants or buyers was rare. One respondent asserted bluntly that, “Office and retail (end-users) do not care about energy efficiency and do not provide input.”

These interviews provided some evidence that owners who also built their building had influence on the energy-efficiency features of the building, and this was consistent with the observations from program managers and market experts presented in Chapter 4. However, the participant and nonparticipant interviews did not provide strong support for the hypothesis that buildings designed for a known occupant were likely to be significantly more energy efficient because of the influence of the occupant on the design process.

In summary, interviewees largely agreed that future occupants typically did not actively participate in the energy-efficiency discussions concerning the design of the building they occupied. Furthermore, even though several owners/builders we interviewed said they had significant influence upon the energy efficiency of their buildings, they also revealed that the actual occupants were rarely involved and their specific desires were rarely considered. For example, though school administrators and company facilities staff might direct the construction of buildings that their organization owned and occupied, neither the lab technicians that occupied the new chemistry lab, nor the warehousing staff that operated the new company warehouse, were asked to participate in the design phase of the building beyond providing specifications for the equipment they needed to house and operate within the confines of the structure.

Recommendations: Building occupants currently have limited influence on the energy efficiency of their space, but this suggests there are opportunities to increase their influence. Based on these findings, we offer two recommendations:

- *SBD should increase its targeting and outreach to customers who are likely to invest in developing buildings for their own occupancy. These activities should be directed at the ultimate decision-makers.*
- *SBD should enhance outreach and education of customers that lease space to inform them about the advantages of energy-efficiency in their space so that they incorporate energy-efficiency in renovations and specify efficiency requirements when they lease space.*

Market Trends Affecting Commercial Building Energy-Efficiency Programs

In Chapter 4, we introduced several key assertions about the real estate market that could affect energy-efficiency programs aimed at commercial development. In the research for the present chapter, we sought to validate or invalidate these assumptions by testing them with participants and nonparticipants. As a part of our interviews we also wanted to identify some market trends that would help SCE better target their energy-efficiency programs for the commercial market. The respondents were queried about the following trends:

- What energy efficiency measures do they expect to see installed/used more frequently in the next few years?
- What market factors are driving energy efficiency?
- What types of buildings are likely to lead the adoption of energy-efficiency measures; and which ones are likely to lag in adopting energy-efficiency measures?

- What effect is the economic situation likely to have on the kind of development occurring in the commercial real estate sector?
- What "bright spots" are likely to occur in this market?
- What role will energy codes play? What about certifications such CAL GreenCode and LEED?
- What is the split between renovations and new construction likely to be in the near future?
- Are financial constraints likely to impinge upon commercial development?

If the responses permit, we offer recommendations for the SBD Program in the following sections.

Energy-Efficiency Measures and Technologies

Participant and nonparticipant interview respondents predicted that the following energy-efficiency technologies or approaches would be increasingly adopted (in descending order of prevalence) in the marketplace:

- Lighting upgrades – new technologies beyond CFLs
- Efficient HVAC
- Solar systems
- VFDs
- LED lighting
- LEED certification
- Thermal storage
- Dual-glazed windows
- Time-of-use rates enabled by smart meters
- Building automation and retro-commissioning
- Photovoltaics on roofs and over parking lots
- Occupancy sensors
- Photo luminescent exit signs
- Efficient roofing materials, skylights, and green roofs

Market Factors Driving Energy Efficiency

We asked the interviewees what forces they felt were contributing to, or sustaining the demand for, energy efficiency in the commercial real estate market.

According to SBD participants, the primary influence driving the demand for energy efficiency was almost universally identified as the cost of energy. An emerging new pressure was the desire to reduce energy related greenhouse gas emissions. One of the participants summed it up in this manner, "In 2008 the key driver was energy costs. In 2009 it was GHG emissions. In 2010 it's the combination."

To a limited degree, Program participants also cited the societal desire to contribute to the reduction of energy consumption as a key motivator. Some respondents also cited the importance of adopting more sustainable energy practices as part of their overall branding strategy.

Nonparticipants, on the other hand, generally felt that the increasing regulatory push for energy efficiency was forcing them to respond. They also felt that the shift in the regulatory environment was establishing a new competitiveness factor in the market.

Recommendations: Based on the responses of both Program participants and nonparticipants, we provide the following recommendations:

- *SBD should continue to stress the utility bill savings produced by energy-efficiency improvements, but also note the greenhouse gas and environmental benefits.*
- *In addition, the Program outreach should stress the competitive advantage of energy-efficient space in the market as businesses continue to look for ways to trim costs.*

Energy Efficiency and Building Type

Somewhat in contrast to the findings from the program manager and market expert interviews (see Chapter 4), most of the SCE market area respondents did not identify any variability in the emphasis on energy efficiency based on the different types of structures being built in the current market. However, one noted that, in the education building sector, more attention was often given to energy efficiency in labs due to their higher energy consumption; this was in contrast to residency halls at the same campus where energy-efficiency was under-emphasized because occupant behavior was so variable. Another building type where energy efficiency was less intensively applied was in the retail sector, where over-emphasis on customers' comfort was an important feature of the structure's retail marketing characteristics. These findings for education facilities and retail buildings are quite consistent with those reported in Chapter 4.

One expert that we interviewed explained the effect of building type by saying that the issue is that buildings are not regarded by their users as merely physical spaces, but as structures that serve a purpose. In retail, for example, the primary purpose of the space is to sell something. Occupants in such situations are likely to simply regard additional energy cost (from inefficient buildings or operating practices) as a business expense, but not a wasted cost.

Building Types Likely to Lead Adoption of Energy-efficiency Measures

Asked which building types appeared to be leading the way for increased energy efficiency, those Program participants and nonparticipants who identified any specific building types pointed to:

- Government sector buildings
- Academic facilities

- Data centers
- Retail facilities

Building Types Likely to Lag in Adoption of Energy-efficiency Measures

When asked which types of buildings were likely to be the slowest to adopt energy-efficiency measures, the most common responses were:

- Hospitality
- Retail
- Office buildings

We note that retail buildings appear both as leaders and slow adopters. Based on the other information gathered in this study (see Chapter 4), we believe this is largely because of the differences in retail space; small retail or strip malls tend to be less attuned to energy-efficiency issues, whereas large, national chain retail stores tend to be more aware of energy efficiency and sophisticated about increasing efficiency.

Recommendations: Given the difference between small/strip mall and large retail, we make the following recommendation:

- *SCE should continue its efforts to simplify the Program for small buildings and explore ways to influence small retail and strip malls in particular.*

Effects of Economic Downturn

The respondents' views about the effect of the downturn differed between those involved in private and public building construction. In essence, the former has been essentially at a standstill, while the latter has experienced a boost due to the effects of the Recover Act monies. Key observations include:

- Very little private sector new construction is occurring—respondents feel that capital constraints have all but halted most private commercial real estate development.
- Activity in the private sector is almost limited to renovations, but even that activity is limited by weak demand.
- Financing for private construction is severely constricted—only internally financed projects are able to proceed
- Public sector building is increasing, funded by fiscal stimulus spending—most activity is in medical facilities, municipal structures, and educational buildings.
- Public construction is benefiting from dramatic reductions in construction costs—construction costs have dropped 30% to 40%.

In addition to contributing to a dramatic slowdown in commercial development, the survey respondents also noted two ancillary effects of the downturn on the development of energy-efficient buildings. First, reduced building activity has, in turn, diminished the volume of plan review applications being processed by local jurisdictions and the result has been greater scrutiny by municipal development services staff of all non-standard plans. Since very energy-efficient buildings are likely to be at least somewhat non-standard, they are likely to get more scrutiny, which can result in costly delays.

Second, despite the fact that construction in the public sector is still relatively active, the budget crisis affecting public organizations has impacted their ability to invest in more energy-efficiency measures. One SBD participant noted that if they had been planning their construction project a few years earlier, they might have considered having it LEED certified, but current budget constraints precluded investing in the $25,000 LEED registration fee. She noted that this led them to “emulate” LEED (instead of actually submitting the project for certification and paying the added fees) and this resulted in a very costly error that substantially increased the energy use of the building. Had they gone through the certification process, she believed the error would have been avoided.

Recommendations: Based on these observations about the effects of the economic downturn, we recommend the following:

- *The Program should explore ways to minimize the additional time required by building departments to review energy-efficient designs. Working directly with code officials is one option; another is providing information to Program participants that would help expedite building department review.*
- *If they have not already, economic analyses and information provided by the Program should reflect any recent reductions in the cost of energy-efficient construction and products..*

Other Observations about the Commercial Building Market

In general, respondents indicated that energy-efficiency programs and improving energy efficiency in conjunction with renovation were becoming increasingly attractive to both buyers and builders. All the respondents felt that, with the exception o f special purpose buildings, renovations would eclipse new construction.

Effects of Energy Codes and Certifications

Finally, this study looked at the effect of building codes and certifications that are likely to influence and guide market development over the next five years. Likely trends in regulations and rating systems include the evolution and acceptance of new Title 24 energy codes and implementation of the CALGreenCode. All the respondents appeared to believe that energy codes would have a huge impact upon the market. SBD participants and nonparticipants almost all agreed that regulation, at both the state and local level, was accelerating the move towards energy efficiency. Whether the respondents liked or disliked the increasing rigor of regulatory requirements, almost all felt this trend was inevitable.

Many respondents, however, were unfamiliar with new emerging energy codes, such as the CALGreen Code, but they nonetheless felt that regulatory requirements would continue to raise the bar for the commercial real estate development market. The LEED rating system was cited by many of the respondents as an example of what to expect for future regulations. Public recognition was seen as contributing to LEED’s role as a leading measure of a “green” building. Some respondents felt LEED should take the intended use of a building into account more. In general, respondents noted the concept of “green” appeared to be more prevalent in the market and nonparticipants noted that it was adding value to projects.

ENERGY STAR was seen by some respondents as having suffered loss of credibility due to recent adverse publicity. Many participants said they used it for appliances, but not to certify the building. ENERGY STAR, like LEED, was felt by some respondents to not take the use of the building into account, thus rendering it unusable for specific needs of some occupants, such as the housing of live animals in pet stores.

Emerging certifications, like Earth Advantage Commercial, were mentioned by several respondents, but these certifications are still too new to the marketplace to be able to judge their future impact. Other pending standards and codes mentioned included enhancements to the IECC model code being proposed by the American Institute of Architects (AIA), New Buildings Institute (NBI), and the International Code Council (ICC). Other drivers include the Architecture 2030 Challenge and federal legislation pending before Congress.

Recommendations by Interviewees

Although this research focused primarily on commercial real estate market characteristics and trends and their effect on energy efficiency, we were able to collect some useful direct recommendations from SBD participants as well as nonparticipants about the Program. As noted earlier, the participants interviewed were all recent participants. The recommendations included:

- *SBD should conduct outreach to potential participants even earlier in the development cycle.* This feedback from interviewed participants reinforces the validity of the Program’s recent emphasis on early intervention in construction projects.
- *SBD should reach out to local/municipal planners to ensure they are able to accommodate SBD into the development process at the earliest possible time.* There may be opportunities to leverage the Sustainable Communities Program to accomplish this.
- *Administrative requirements should be streamlined to make the Program more attractive to smaller commercial developers.* This feedback also validates recent efforts of the Program to provide an express program for these groups and software where customers can enter their own data on line to determine the rebate amount and apply.

6. Market and Economic Trends

Objectives

The information presented in the preceding chapters provides an overview of the SBD Program market penetration, characteristics of the current commercial building market, and perceptions of Program participants and nonparticipants in the SCE-area about the commercial building market and SBD Program. This chapter focuses on likely market trends from a macro level and specifically on key economic trends. The specific objectives of our study of these trends include the following:

- Examine construction rate and building type trends expected during the next three years
- Identify uncertainties and influences that might affect the market[17]

These macro-level trends provide the background that will significantly influence the Southern California commercial building market. Given the recent national, and even global, economic downturn, the economic trends are not likely to be "business as usual." Consequently, it is important to examine the probable underlying trends to understand what major forces are likely to influence the SCE area commercial building market and to assess how the SBD Program might be shaped to respond to them most effectively.

Approach

Cadmus relied primarily on literature and secondary studies to provide information on market and economic trends. We reviewed industry publications and journals and examined construction industry forecasts; economic forecasts; government statistics and forecasts; construction, development, and real estate trade journals; and general press sources. We supplemented the literature review selectively with interviews with experts who monitor and analyze broad market trends.[18] This information was used to produce both qualitative and quantitative information about the impacts of the economic downturn on what levels and types of building and development activities are most likely over the next three to five years.

Findings

Given the sharp downturn in the economy, the focus of our review of macro trends has been on recent history and projections over the next few years for the major economic indicators, taking into account the effects of the recession.

Overview of Effect of Economic Downturn and Expectations

The economic and financial collapse during the last two to three years has been accompanied by a drying up of credit that has impacted every aspect of the U.S. and global economy. Residential construction has been particularly hard hit, and construction in the commercial sector has slowed

[17] The original work plan included in this task a review of trends in ownership arrangements and energy efficiency. Since these were covered through the literature review and interviews discussed previously, they are not presented in this chapter.

[18] Sources are cited in the discussion that follows.

as well. Lack of access to credit has affected the ability of developers to get financing and unemployment has reduced the demand for new nonresidential buildings.

There have been mixed reports as to the impact of the economic recession on trends in the commercial construction industry, though the majority of our sources indicate steep declines in new commercial construction starts. The range of views during 2009 and 2010 is illustrated by the following observations:

- The Plunkett's 2009 Almanac[19] reported a positive trajectory on the commercial real estate and industrial side. It stated that: office occupancy rates were climbing in many markets; construction for the government, education, and health care markets was booming; and the hotel sector was strong, with new construction aimed at taking advantage of high room rental rates. The report also noted, however, that trends in the industry, largely as a result of the economic crisis, indicated that many major developments were delayed, downsized, or canceled.
- In late 2009, McGraw-Hill forecast that the economy would remain choppy in the wake of the longest and steepest recession since the Great Depression. According to McGraw-Hill, new development would continue to be dragged down by high unemployment and tight credit markets and reported that "this year [2009] was particularly tough for the construction industry, with the value of starts expected to plunge 25% to $419 billion." McGraw-Hill estimated in their 2010 Construction Outlook report, however, that the industry would experience a rebound with starts expected to climb 11% to $466.2 billion[20].
- In July 2009, the AIA Consensus Construction Forecast Panel projected a 16 percent decline in nonresidential construction activity in the last half of 2009 and an additional drop of almost 12 percent in 2010[21]. The steepest declines, according to this report, would be in office, retail, and hotel, accounting for a 25% decrease in 2009, and an additional drop of 12% in 2010.
- An article by CB Richard Ellis' Steve Navarre, Southern California managing director of project management in the Newport Beach office of CB Richard Ellis Group Inc., reported that a survey of commercial builders pointed out large "ground up" projects were delayed by big national chains as well as major businesses. Sub contractors are continuing to discount their services at a rate of 10% - 20% from 2008 prices in order to win new business, and maintain the health of their core businesses.[22]

In some building categories—retail, office, and warehouse buildings, for instance—the economic downturn has created an inventory of surplus buildings. The existence of older, less efficient large format retail or warehouse/distribution spaces provides new territory for developers who have access to financing and are willing to renovate them.

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[19] Available at http://www.plunkettresearch.com

[20] McGraw-Hills' 2010 Construction Outlook report http://construction.com/AboutUs/2009/1016pr.asp.

[21] AIA Consensus Construction Forecast, July 2009 issue, (http://info.aia.org/aiarchitect/thisweek09/0710/0710b_consensus.cfm).

[22] *Orange County Business Journal*, May 4, 2009, "Construction Stalls in First Quarter"

Some developers and builders see the economic climate as an opportunity to build as construction costs have decreased significantly. Developers and retailers who have access to capital will be able to take advantage of the drop in construction costs to renovate these existing buildings. If their companies are well financed, this is an especially appealing time to complete larger projects, or to include energy efficiency as a larger part of their construction budgets.

Another positive finding is that planned investments in energy efficiency are on the rebound. Findings from Johnson Controls' 2010 Energy Efficiency Indicator for North America Survey[23] completed April 2010 indicate that "planned energy efficiency investments across North America have rebounded since 2009, motivated primarily by reductions in operating costs, public image, corporate sustainability strategies, government and utility incentives, and climate change concerns". The survey specifically found:

- Planned investments in energy-efficiency improvements are on the upswing anywhere from 5% to 9% over 2007 spending.
- Large businesses are much more likely than small businesses and organizations to invest in energy efficiency.
- Government and educational organizations are more likely than other sectors to invest in energy-efficiency upgrades.
- The retail sector lags in terms of energy-efficiency investment

There are several additional relevant findings from the Johnson Controls study:

- The economic climate has had a mixed impact on energy-efficiency investments.
- Lack of access to capital constrains many organizations.
- Building efficiency is a top priority for those businesses seeking to shrink their carbon footprint. A growing number of businesses see a focus on improving energy efficiency in existing buildings as the best way to address the carbon reduction targets being set forth by corporate sustainability efforts.
- 38% of survey respondents indicated that energy efficiency in buildings was their top priority.

Economic Indicators and the Building Market

Economic indicators suggest that the major recession is coming to an end, but reaching pre-recession levels of employment and nonresidential building activity will take significantly more time. According to Chief Economist Baker of the American Institute of Architects, economic recoveries typically follow a predictable path as follows:

1. The stock market typically recovers first.
2. Following a stock market rebound, GDP typically begins to recover an average of two quarters later.

[23] http://www.johnsoncontrols.com/publish/us/en/news.html

3. Next, payroll employment increases three quarters after a GDP rebound. Payroll employment reduces vacancies in the nonresidential sector, leading to improvement in nonresidential construction starts.

4. Nonresidential construction starts to rebound about two quarters after payroll employment recovers.[24]

Assuming no "double dip" recession, the current recession experienced a stock market bottom in the first quarter of 2009, with GDP appearing to bottom out in the third quarter of 2009. According to Baker, this would suggest that payroll employment would begin to recover in the second quarter of 2010, and nonresidential construction starts should see some improvement towards the end of 2010 or in 2011.[25]

The available indicators concur with Baker's assessment that the recovery of nonresidential construction is close. National nonresidential spending is showing a small improvement overall, with much of the increase due to public spending (see Figure 10).[26]

Chief Economist Haughey of Reed Construction Data predicts that nonresidential construction spending will level out beginning in 2010, with eventual gains in 2011. Federal stimulus funds applied to building construction will not be spent at significant levels until the latter half of 2010, but the expected $30 billion in spending on buildings will be significant. Gains in the nonresidential sector in 2011 are expected to be due to the recovery of the private sector, and gains are expected to be more significant than the limited gains from government spending.[27] According to Ken Simonson, Chief Economist of AGC of America, changes in spending for nonresidential construction in 2010 are expected to hover at between 0% and -5%, with the stimulus keeping the sector from experiencing even higher losses.[28]

[24] Dow Jones, U.S. Dept. of Commerce, U.S. Dept. of Labor, McGraw-Hill Construction as cited by Kermit Baker, Chief Economist, American Institute of Architects. 2010 Market Insights Webcast Series: Construction Outlook: Ready for a Rebound. (from 5-4-2010).

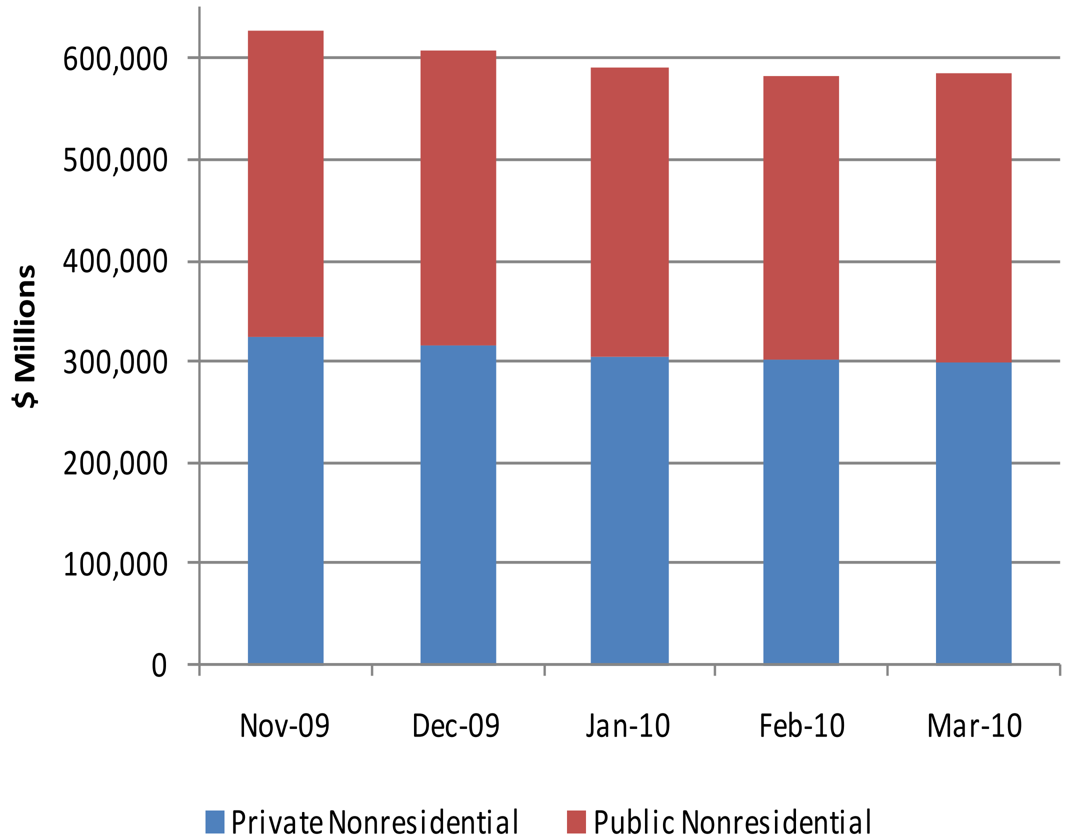
[25] Kermit Baker, Chief Economist, American Institute of Architects. 2010 Market Insights Webcast Series: Construction Outlook: Ready for a Rebound. (from 5-4-2010).

[26] US Census Construction Spending (from website 5-17-10).

[27] Jim Haughey, Chief Economist, Reed Construction Data. 2010 Market Insights Webcast Series: Construction Outlook: Ready for a Rebound. (from 5-4-2010).

[28] Ken Simonson, Chief Economist, AGC of America. (5-4-10). 2010 Market Insights Webcast Series: Construction Outlook: Ready for a Rebound.

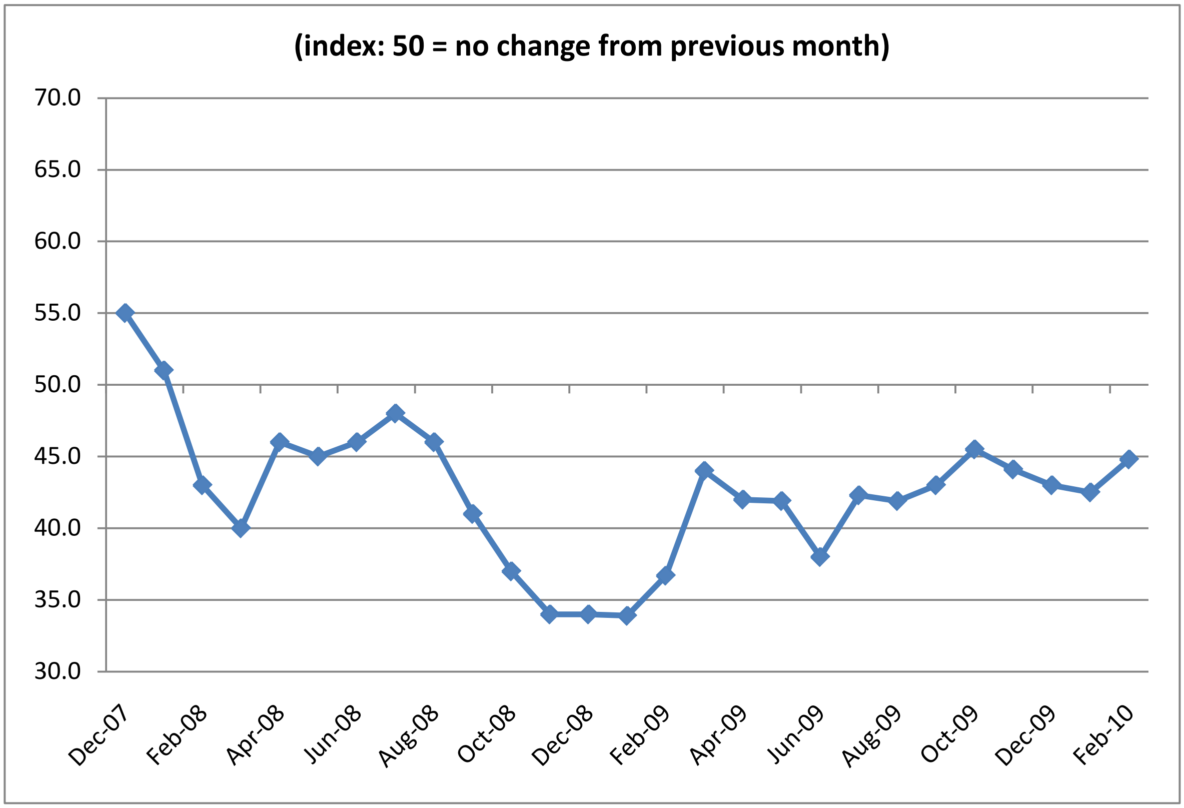
Figure 10. Nonresidential Public and Private Construction Spending, Annualized[29]



These indicators suggest that the construction industry as a whole will soon see improvements. The Architecture Billing Index (ABI) is an early indicator of construction spending derived by surveying architects on whether their billings increased, decreased, or stayed the same in the month that just ended. The ABI leads nonresidential construction activity by approximately 9 to 12 months. Any number below 50 indicates falling demand. The ABI appears to be on a slow upswing, which suggests future improvements for the construction industry as a whole (see Figure 11).[30] This is in line with the typical unfolding of a recovery outlined by Baker, where payroll employment drives nonresidential construction activity, making it one of the last things to see improvement in an economic recovery.

[29] Construction spending is total, not just spending on buildings.
[30] AIA Architectural Billings Index

Figure 11. Architecture Billings Index Trending Up



Overall, the construction projections of the sources cited above tend to agree. The expectation is that nonresidential construction will improve in late 2010 or into 2011, but the upswing will be quite gradual.

Population Trends

According to Census figures, California's population grew 9.1% from 2000 to 2009, compared to U.S. growth of 8.8%.[31] The early 2000's began as expected by continuing a trend of domestic and international migration into the Sun Belt from previous decades, providing Southern California with ample workers to grow the economy. However, the subsequent housing boom and bust significantly slowed overall population growth, with Los Angeles being a good example. According to the Brookings Institute report on "The State of Metropolitan America," as housing became prohibitively expensive, migration patterns reversed from 2001 through 2009. As a result, from 2000 to 2009 Los Angeles lost 1,337,522 people to domestic out-migration, and gained only 803,614 international migrants. California, and Los Angeles, have such large populations that the lost population resulted in only about a 5% net reduction in overall population than was originally predicted, and the total population did increase due to births. Given these data for Los Angeles, the SCE territory probably experienced, overall, a population increase that was about 2% to 5% less than initial projections.

[31] US Census Bureau, Quick Facts, Population Estimates. Accessed 5/20/10.

In the 10 counties included within the SCE territory, the population is projected to grow 10.9% between 2006 and 2016.[32] Slower than average population growth is expected in coastal areas with faster population growth concentrated in inland "exurbs." In the period from 2006 to 2009, Riverside (see Figure 12) had the most growth of any county within SCE territory, at 6.7%, followed by Kern County at 5.8%, and Tulare at 5.4%. Some rural counties actually lost population from 2006 to 2009, with Mono losing 1.7% and Inyo, 1.6%. Expensive coastal areas grew very slowly, with LA County experiencing slow growth of 1.9%, and Santa Barbara and Ventura growing 2.8% each from 2006 to 2009.

Due to out-migration, population growth was relatively flat in the past decade for the SCE area as a whole, growing at an average rate of less than 1% in the last 3 years (see Figure 13). Projected growth is expected to increase in the coming years, to annual rates between 1.1% and 1.2% from 2012 to 2016. The projected acceleration of the Southern California population and workforce should support growth of the economy in the years to come.

[32] CALTRANS data

Figure 12. SCE Territory Population, by County

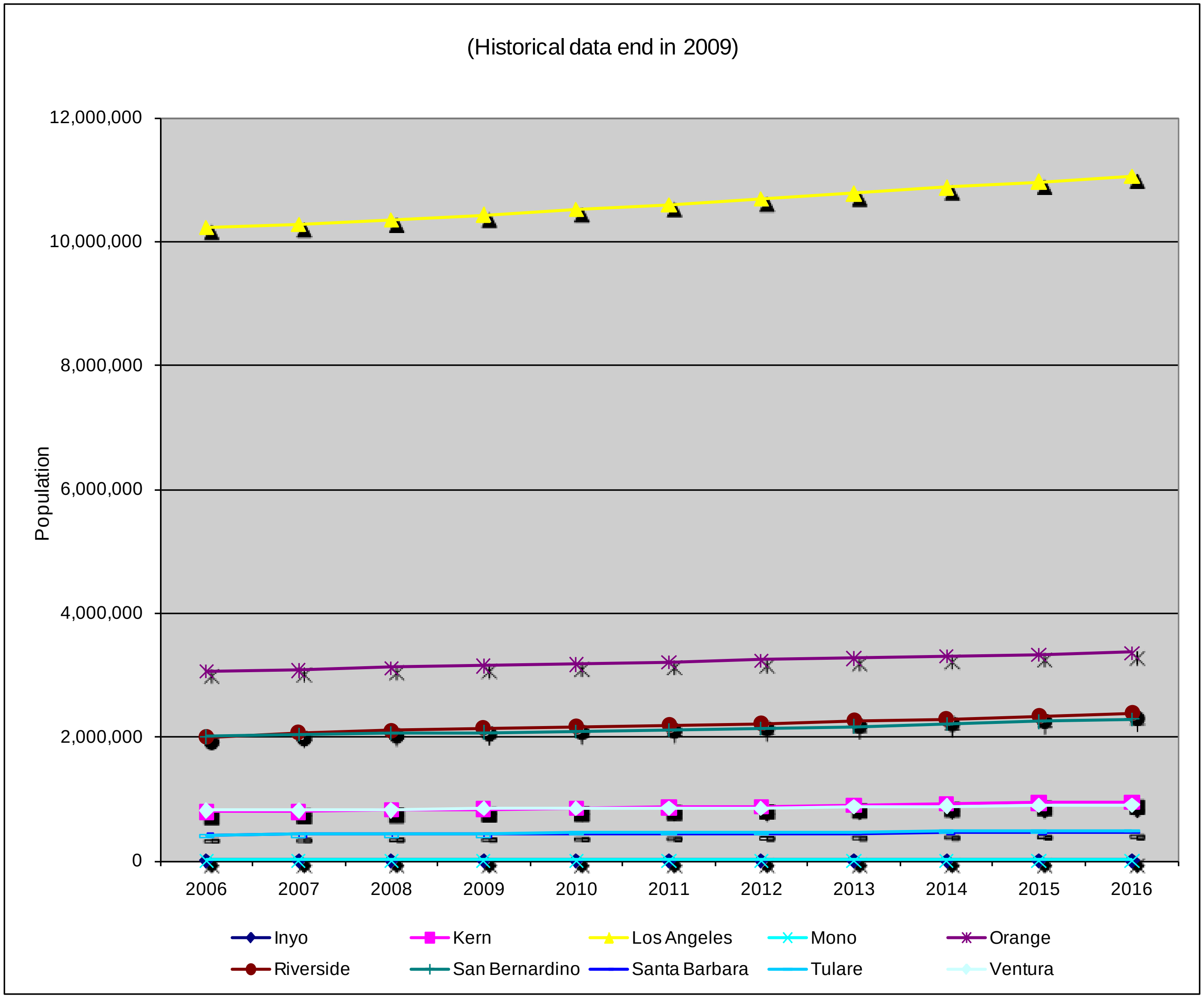
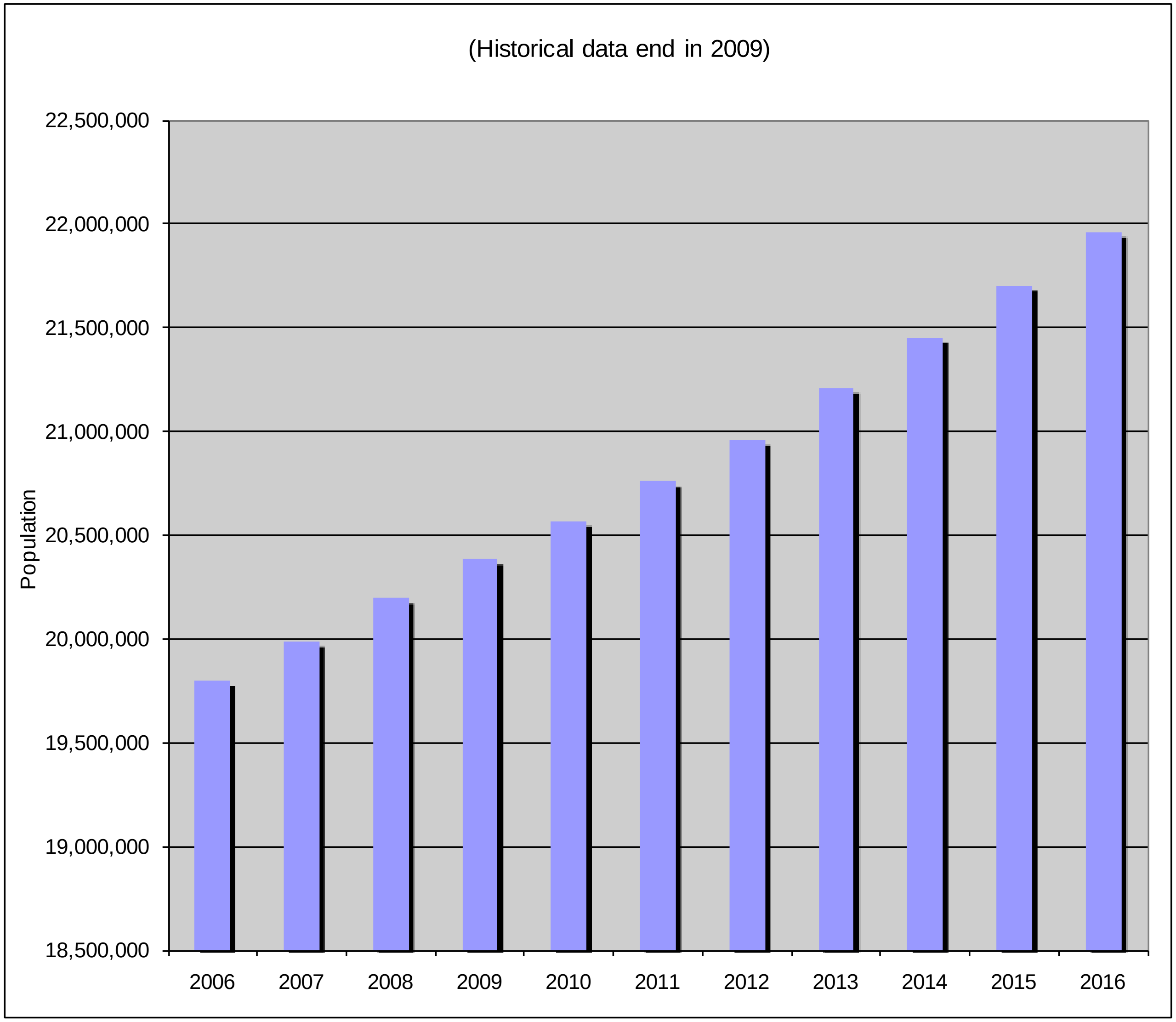


Figure 13. SCE Territory Population, All Counties



Industry and Employment Data

Population growth is directly linked to employment trends, and the growth in employment by industry type affects the types of buildings that are built. According to The Reed Construction data forecast, the commercial construction markets in most southern California cities are exhibiting slow growth as of May 2010.[33] As noted, growth in the nonresidential building sector is linked to growth in industry payrolls.[34]

According to California's Employment Development Department, industries with the largest share of employment in the counties included in SCE's service territory were (as of 2006) Trade/Transportation/Utilities (20%), Professional/Business Services (15%), and Local Government, Manufacturing, and Education Services/Health Care/Social Assistance (11% each) (see Figure 14). According to projections from the Department, in 2016 the largest employment in the SCE counties will be in the same five sectors, with some slight shifts in their relative shares (see Figure 15).[35] The employment estimates for 2006 and 2016 are displayed together in Figure 16.

To assess what types of buildings will be built, it is important to look at where the growth is projected to occur. As shown in Figure 17, the industry with the most additional jobs projected between 2006 and 2016 is Trade/Transportation/Utilities, with an increase of 193,350 jobs. The next largest projected gains are for Education Services/Health Care/Assistance, with expected growth of 188,780 jobs (a 23.5% increase). Professional/Business Services and Leisure/Hospitality follow, with expected growth of 182,400 jobs (a 16.8% increase) and 110,690 (a 14.8% increase), respectively. Local Government is also projected to gain a respectable 104,520 jobs (a 12.3% increase). Manufacturing is the only industry with expected declines, with a projected loss of 34,530 jobs, or 4.2% between 2006 and 2016.[35] Across all categories, there is a total projected employment gain of approximately 888,660 jobs by 2016, which represents an 11.4% increase from 2006.

It is important to note that most of the Southern California Industry Projections supplied by the California Employment Development Department discussed above were completed in the fall of 2008, with a few being completed in 2009. As the downturn was just beginning when those projections were being prepared, the full extent of the downturn could not be predicted and reflected in the projections. The Department was aware that the building boom had ended though, and the projections were somewhat more conservative as a result.

The forthcoming 2008–2018 projections will reflect the downturn numbers, and projections for most of Southern California are expected to be complete by the end of this year.

- *We recommend that SCE take steps to obtain the newest California Employment Development Department numbers when they become available.*

[33] Reed Construction data forecast
[34] *ibid* Baker 2010.
[35] California's Employment Development Department

Figure 14. SCE Counties 2006 Industry Employment

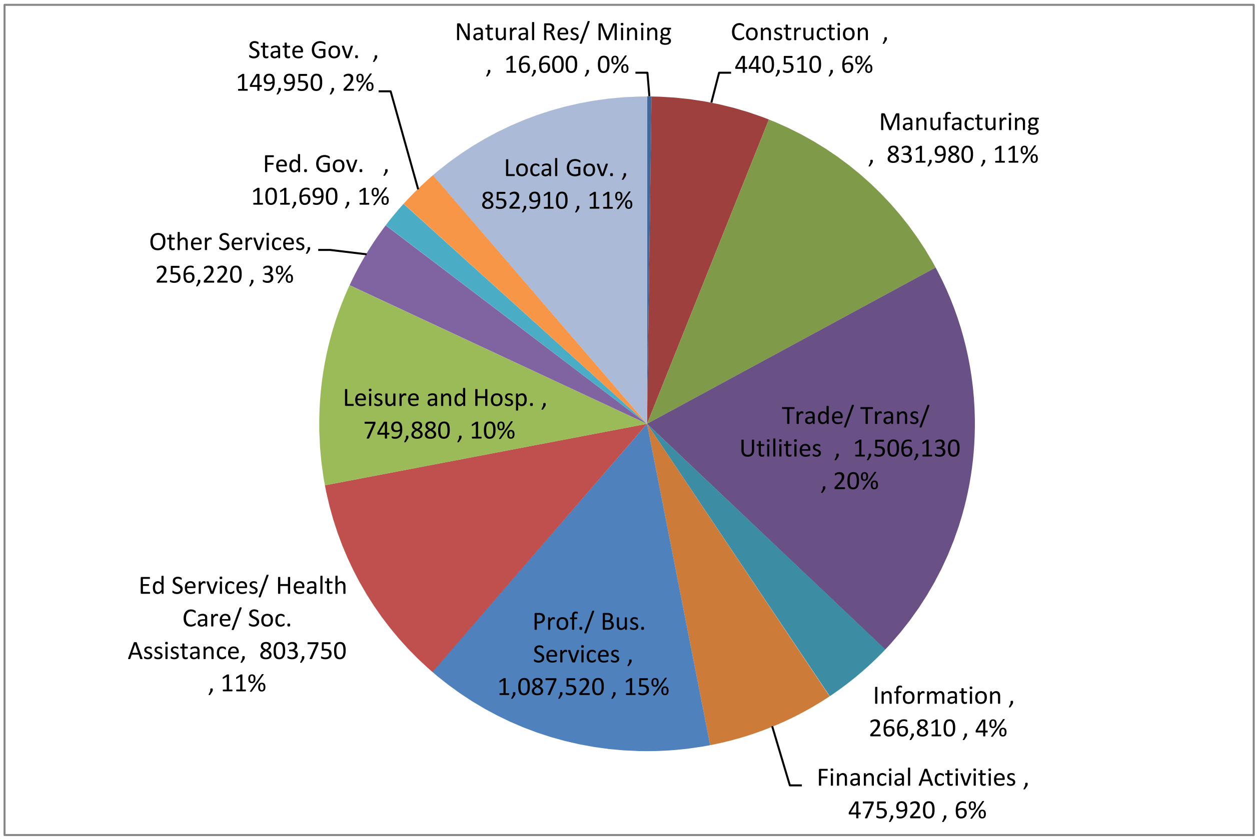


Figure 15. SCE Counties 2016 Industry Employment

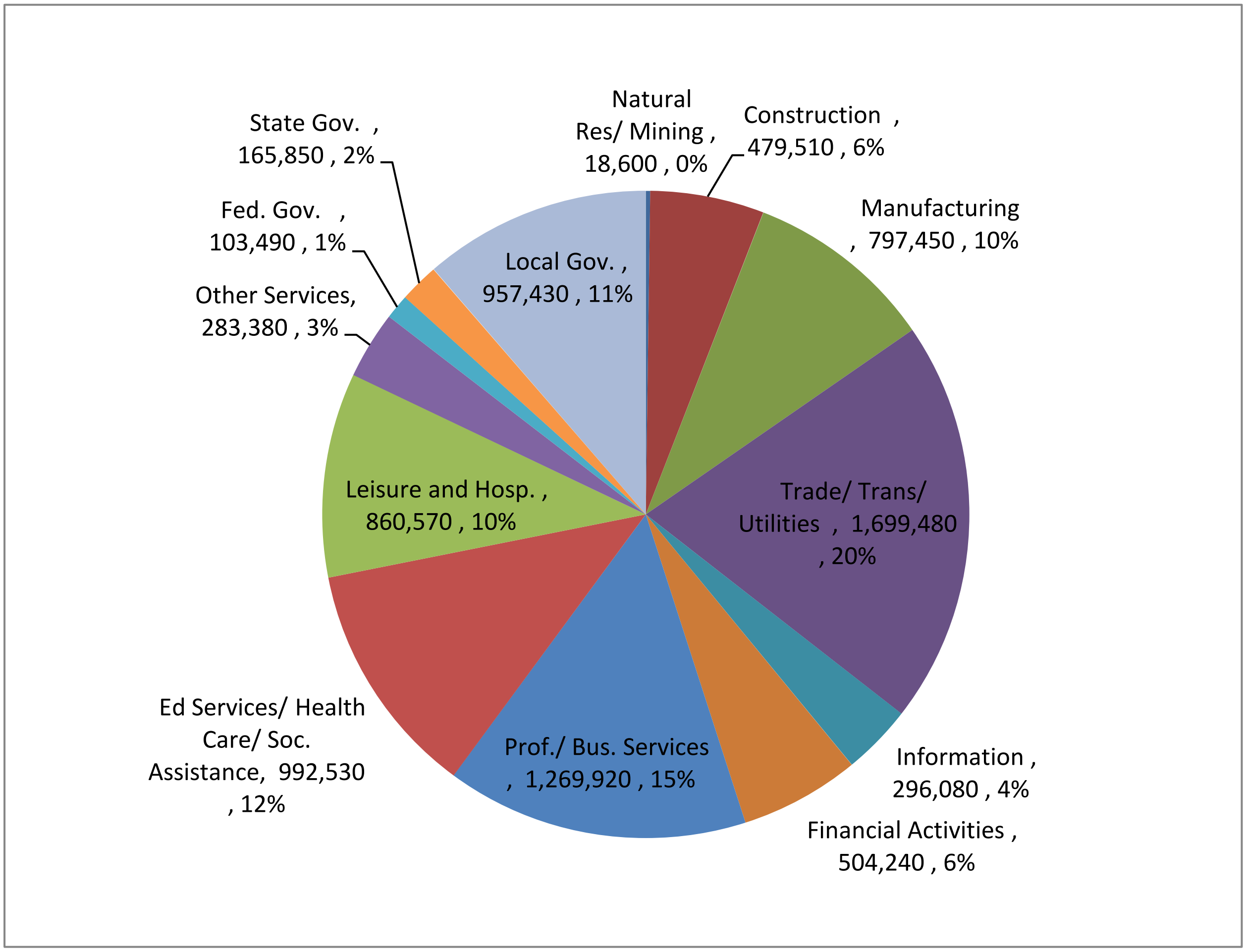


Figure 16. SCE Counties 2006 and 2016 Industry Employment

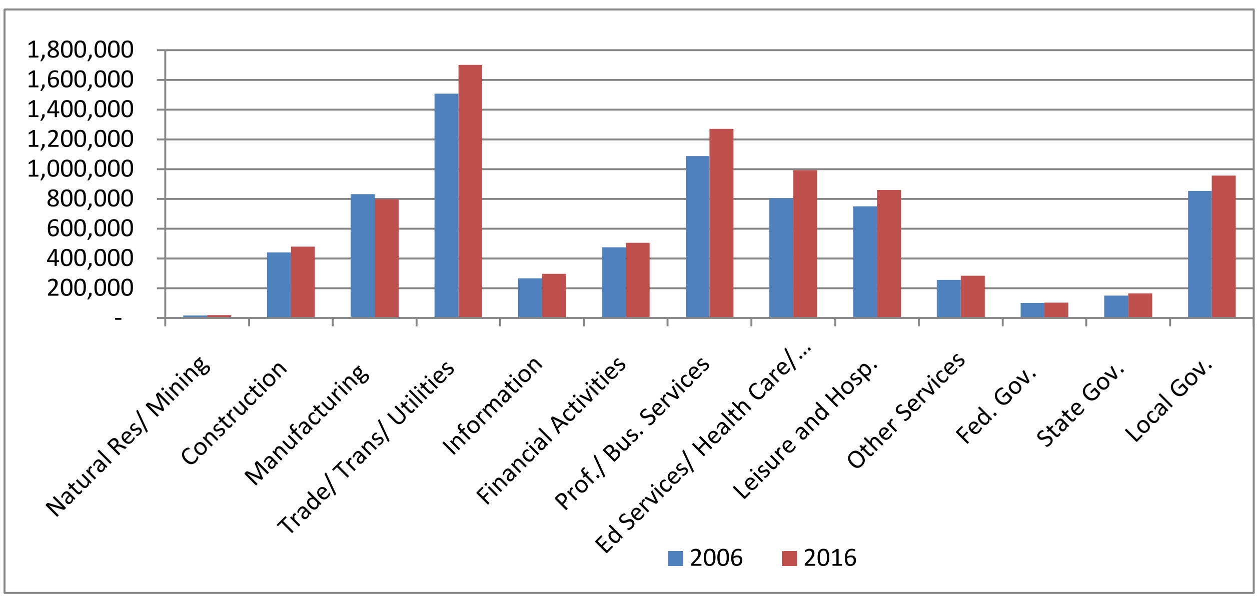
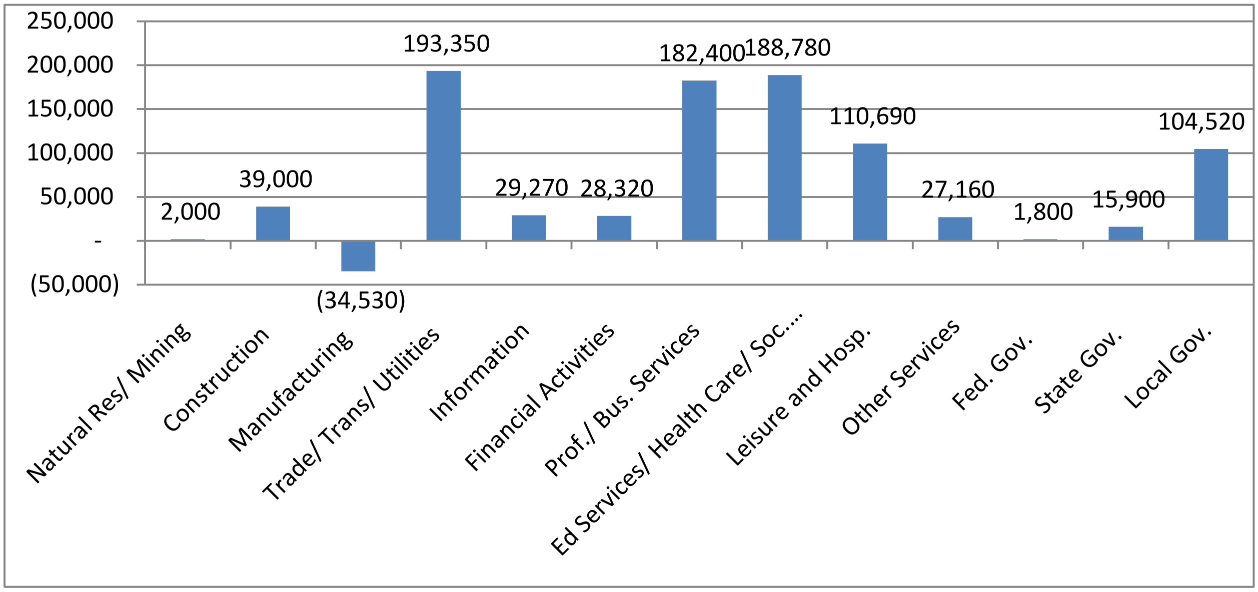


Figure 17. Change from 2006 to 2016 in SCE Counties Employment



Implications for the SBD Program

These macro statistics and projections provide useful information for anticipating commercial building market trends in SCE's service area and developing the background for Program planning. Given the significant recent disruptions in the economy and the construction market, the projections must be used cautiously and considered in a much broader context based on the other types of information presented in this report.

Although the different ways business types are classified by various organizations (e.g., McGraw Hill and California Employment Development Department) make it difficult to provide apples-to-apples comparisons, there are some clear observations that can be made about employment projections and the predictions of potential savings offered in Chapter 3. The healthcare building sector is identified in Chapter 3 as a target area for the SBD Program. Similarly, as shown here:

- *Healthcare, in combination with education and social services, is the industry with the second largest projected increase in employment and, therefore, a large need for new buildings and floor space.*

Office/Bank buildings, as seen in Table 13 (p. 36), have been underrepresented in the Program. Although the potential energy savings in this category are not among the largest, Figure 17 suggests that growth in employment in the broad category of Professional/Business Services, which would include banks and offices, will be the third largest of all the categories. As a consequence, we note:

- *Even though potential SBD energy savings in office/bank buildings are not considered to be among the largest, the employment growth projected in professional/business services and the trade/transportation/utilities sectors is very large and will likely lead to conversion to or construction of a significant amount of new office space in the next five years.*

7. Program Best Practices

For a number of reasons nonresidential building energy-efficiency programs are finding it difficult to cost-effectively increase their energy savings. Challenges faced by new building programs include:

- Many of the low-hanging efficiency fruit have been harvested (e.g., CFLs)
- New targets for efficiency improvements are more costly up front
- Increasingly more stringent energy codes have the effect of “raising the bar” for expected energy savings
- Recent economic conditions are changing the mix and number of buildings being built so efficiency programs have to adapt

The cumulative effect is to make it more challenging for programs such as SBD to meet their savings goals. To increase understanding about these challenges that can be used to inform the SBD Program, we conducted a review of best practices in nonresidential building energy-efficiency programs and present a summary of the findings here.

This compilation is not to suggest that the Savings By Design staff are not currently following best practices. The purpose of this section is mainly to serve as a comprehensive and updated compilation of practices identified that the Savings By Design Program may want to refer to and draw upon where useful and refer to as a checklist in the future.

Program Component Best Practices

Based on our review of best practices research, this first section is organized around specific components of new nonresidential building efficiency programs. The following list of suggested best practices has been updated and refined to reflect current market conditions and our findings during this research related to the particular characteristics of Savings By Design.[36]

Program theory and design:

- Develop a sound program plan; if possible have a clearly articulated program theory
    - Developing a straightforward program logic description can assure that everyone concerned with the program has a clear understanding of what the program seeks to achieve.
    - Committing these intentions to paper helps to reveal changes in the market conditions (such as a shift to renovating existing building instead of building new construction) that might otherwise pass unnoticed, even though they might profoundly affect the program.
- Work with the large nonresidential market players directly

[36] The description of component best practices is based on the following report, but tailored to SBD: *National Energy Efficiency Best Practices Study: Volume NR5 – Non-Residential Large Comprehensive Incentive Programs Best Practices Report,* December 2004, Prepared by Quantum Consulting, Inc.

  - Actors in this marketplace are often savvy, but have unique operations whose requirements and needs are essential to understand. Without such a direct involvement it is likely that the program will not address their needs effectively, or it can lead to "gaming" or non-participation.
- Be ready to consider new programs if the market conditions change substantively
  - Market volatility and changes to the market basics can cause programs to become obsolete in their original form.

Project management:

- Deploy well qualified engineering staff
  - Since SBD engineers will need to collaborate with the client's engineering team it is essential that SBD use technical resources that are clearly qualified, experienced, and understand the delicacy of working effectively with the client's team.
  - Ensure the SBD engineering team has early access to the preliminary design concepts so that changes can be suggested before the project's in-house design team becomes too committed to the existing plans.
  - Consider deploying the SBD team into the field at the time the developments are being sited, so that they can begin to work with the design team before the building siting and orientation have been established.
- Train and motivate field staff and energy service providers
  - Invest in good training and support for program field teams since their attitudes can be critical in this collaborative process.
  - Consider ways to increase the efficiency of field teams, such as providing them with up-to-date briefings on emerging technologies that they can use to help inform clients.
- Ensure retention of good staff
  - Many of these projects can takes years to complete, and often customers will be involved with this program on a repeated basis. Having direct knowledge of the clients and having the personal rapport can be critical to the expansion of clients and the repeat business that they can conduct.
  - Rather than seeing program engineers and marketing personnel as "required" contacts, they should be viewed as an essential go-to experts.

Measurement and tracking:

- Validate that all necessary data are being tracked
  - Validate with the evaluator that all the essential program data are being collected and tracked in a format that can subsequently be used.
  - Ensure that each building is accurately tracked by location, owner, and occupant.

  - Ensure that all equipment and measures are accurately reflected in the program database.
- Ensure that data systems are scalable to accommodate increased program scope
  - Ensure that data collection is synchronized with the programmatic changes that typically affect "live" programs undergoing adjustments.
  - Be sure to clearly capture what data need to be collected to reflect changes in the program. Understand how various types of data will be integrated, and reflect the timing required.
- Use Web-based data entry tools for remote data collection
- Ensure rigorous quality control for data entry; avoid "garbage in"
  - Perform rigorous quality assurance when replicating program forms into Web-based forms. Be careful to choose the appropriate sub-options formats for recording data (drop-down versus multiple radio button formats).
- Track prospects early
  - Identify and contact prospects early in the process.
  - Ensure interaction with the project design team as early as possible.
- Develop outreach around major construction industry events
  - Leverage outreach by attending events that attract major players in the construction or commercial building markets.
  - Seek to position outreach teams as valued information and financial support resources.

Quality control and verification:

- Require post-inspections and commissioning for all large projects
  - Large projects should be subject to post-installation inspections to ascertain the proper installation of all measures and equipment.
  - Large projects should also be subject to a commissioning requirement to ensure that all the equipment and processes have been properly adjusted for the building.
  - If possible, consider regular commissioning surveys to address the degradation of energy-efficiency measures through insufficient maintenance practices.
- Use third party M&V contractors to oversee measurement and verification
  - Best practices studies repeatedly cite the use of third-party M&V consultants as the best way to determine the effectiveness of these programs.
- Tie a portion of staff compensation to independently verified results
  - This will increase the effectiveness of the program's outreach and the degree to which the programs are tracked.
  - On the flip side, be careful to avoid having outreach staff become a nuisance.

Marketing and outreach:

- Understand building technologies and their customer benefits

  - Ensure the outreach team can provide excellent information that reflects the state-of-the-art knowledge about new solutions.
- Promote customer benefits before energy efficiency
  - Be sure that outreach and engineering staff understand that the customer needs (with respect to the building performance) trump the subsidiary energy concerns—the building must serve its purpose before it tries to conserve energy.
- Leverage trade ally opportunities
  - Encourage program staff to develop effective relationships with trade allies, such as equipment suppliers, architects, HERS raters, etc. as a means of extending their influence and reputation.

Evaluation:

- Conduct regular impact evaluations
- Measure both free ridership and spillover effects
  - Though difficult to measure, these impacts should be considered since they may affect the verified results.
  - It is best to decide in advance how the results of these evaluations will be used, especially with respect to compensation.
- Develop realization rates by end-use
  - It is important to perform *ex-post facto* measurement to be able to estimate realization rates by end use, measure type, and other segment distinctions.
- Evaluation metrics must be in line with program goals.

Cross-cutting Topics and Themes

Other best practices studies have taken more of a topical or thematic approach to assessing best practices. These are summarized here, again with reference to SBD where appropriate.

Linkages Among Programs

Increasingly, both utilities and communities are appreciating the synergies that can be gained from closer energy-efficiency program coordination and even the establishment of formal linkages. This strategy of linking requirements also serves to increase program participation without resorting to increased incentives, or programmatic spending – an important criterion at a time that most public programs face large budget cuts.

One example of this convergence can be seen in the requirement that residences in California that apply for a solar incentive must now perform 15% better than Title 24, and ENERGY STAR appliances and high-efficacy lighting must be installed throughout. In Wisconsin, a demand response (DR) program front-loads the DR payments for anticipated service interruptions to induce participants to invest in more energy-efficient equipment. In this way the implementers avoid having the DR program become a substitute for the energy-efficiency investment in the underlying measure itself.[37]

Non-energy Benefits

Another side effect of the looming Climate Change challenge has been the increasing relevance of non-energy benefits, such as water use reduction, emissions reductions, waste reduction, job creation, and increased property valuation. A number of jurisdictions are beginning to link water usage reduction and reduced emissions to their energy-efficiency programs. Indeed, local community programs across California, such as the Green Community Partnerships established between PG&E and some of its local communities, explicitly link the energy-efficiency programs to related greenhouse gas (GHG) reduction goals.

The California PUC is considering ways to quantify the embedded energy associated with water conservation. Water conservation saves energy needed for water transport, purification, and waste treatment. The CPUC has asked utilities to work with water utilities to develop programs that look at embedded energy. Even the energy implications of land use are being studied to understand whether new energy conservation opportunities might be developed through a more thorough integration of overall resource-efficiency considerations into program designs.[38]

The convergence of energy and non-energy benefits has encouraged program innovations. For example, utility power plants have long been the subject of Clean Air Act regulations to limit emissions of ozone, particulate matter, nitrous and sulfur dioxides, and other pollutants. Now, utilities are directly linking energy efficiency and pollution. Texas is the first example of the application of EPA-approved procedures for incorporating the air emissions reductions associated with utility energy efficiency programs into the State Implementation Plan (SIP) for attaining national ambient air quality standards. A study was recently conducted to define energy-efficiency reporting requirements related to air emissions.[39]

New Financing Approaches

New financial structures are being proposed that not only place a value on the GHG reductions, but also capitalize the incremental real estate value that accrues to the improved energy performance of a building. These new financing methods have the potential to substantially increase the amount of capital that could be applied to energy-efficiency investments, and they may be able to finance ”deeper” energy-efficiency investments that would typically exceed the cost-effectiveness limits imposed on the investment of ratepayer funds.

A recent study by CalCEF Innovations[40] examines a number of new energy efficiency financing models that seek to overcome the barrier of high upfront costs. The study provides in-depth examinations of six no-first-cost financing options, including the Clean Energy Works program

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[37] California Best Practices Project Advisory Committee, *Energy Efficiency Best Practices: What's New?* Prepared by Itron. *http://www.eebestpractices.com/pdf/whatsnew.pdf*

[38] California Best Practices Project Advisory Committee, *Energy Efficiency Best Practices: What's New?* Prepared by Itron. *http://www.eebestpractices.com/pdf/whatsnew.pdf*

[39] This research, conducted by Cadmus under contract to the NMR Group, was performed for the Northeast Energy Efficiency Partnerships and the report has not been published yet.

[40] CalCEF Innovation, “Energy Efficiency Paying the way: New Financing Strategies Remove First-Cost Hurdles”, by Bob Hinkle and David Kenny, February 2010

in Portland, the Property Assessed Clean Energy (PACE) programs, on-bill financing (also being piloted in Portland), utility aggregated EE deployment, Efficiency Services Agreement (Metrus Energy), and Managed Energy Services Agreements. All of these financial constructs are currently being deployed, but their evolution will require closer collaboration between the financial sector, the utilities, and the regulatory bodies that oversee energy-efficiency programs.

Reporting, Tracking, and Metrics

There is a new emphasis on tools and energy management systems that seek to measure and monitor building performance more effectively. The following is a sampling of some of these emerging tools and metrics.

Green Building Studio

To encourage architects and designers to evaluate how their design choices will impact energy use, and work toward carbon neutrality earlier in the design process, Autodesk has developed an application known as Green Building Studio. This web-based analysis tool integrates with 3D-CAD/BIM applications and facilitates data sharing between design and engineering personnel. This application helps overcome the barrier that energy modeling requires detailed specifications and thus is applied too late in the design process to influence energy-efficiency related design features. As noted earlier (see Chapter 4), energy modeling is highly valued as a means of convincing building owners to invest in energy efficiency, but the cost is often an obstacle.

DOE State Technologies Advancement Collaborative (STAC)

As discussed previously, commissioning is receiving increased attention as a way to ensure energy savings are occurring. Although a growing number of federal, state, and corporate building owners and trade allies recognize the benefits of commissioning, the practice has not been widely adopted. Part of the reluctance to adopt commissioning is due to the need for tools and technologies that standardize commissioning approaches, thereby simplifying the process and reducing implementation costs. Standardization should also overcome a second barrier: the uncertainty associated with the projected cost savings. To address these barriers, the California Energy Commission (CEC) collaborated with the New York State Energy Research and Development Authority (NYSERDA), the Texas Engineering Experiment Station (TEES), the University of Nebraska-Lincoln (UNL), and the Oregon Department of Energy (ODOE), to develop and market innovative performance testing and diagnostic tools and training for commissioning agents and building owners.

Green Building Metrics:

The California Best Practices Project Advisory Committee's best practices report asserts that the LEED rating system, "…has become the de facto national green building standard for nonresidential buildings." [41] Subsequent pronouncements including Governor Schwarzenegger's Executive Order S-20-04, establishing a 15% energy efficiency savings goal by 2015, explicitly cited the LEED standard. As a result energy-efficiency programs are increasingly using the popular LEED-NC rating to launch forward-leaning programs that begin to also measure conformity with GHG emission reduction goals and other climate impacts.

[41] California Best Practices Project Advisory Committee, *Energy Efficiency Best Practices: What's New?*

One example of how LEED is influencing and guiding energy efficiency standards in the nonresidential sector is Oregon's Business Energy Tax Credit (BETC). The very successful BETC offered up to $200,000 in incentives for new construction projects that attained specific Energy and Atmosphere Credit points as part of the LEED-NC certification.

Several respondents in the SBD evaluation study cited "green building" as an important emerging trend in the nonresidential market, so the application of standards and metrics to these approaches is critically important to accelerate widespread adoption and to improve the ability to forecast energy savings derived from these construction approaches.

Energy Performance Management Systems:

One approach to harvesting more energy efficiency from new and existing nonresidential buildings depends upon the more efficient monitoring and "tuning" of building energy management systems. Over the last 10 years, Energy Service Companies (ESCOs) have provided energy-efficiency services to large nonresidential customers. ESCOs can provide comprehensive energy management services that include energy audits, design engineering, installation, and financing of equipment and the measurement and verification of the energy savings. In recent years the business model for ESCOs has shifted away from the Standard Offer Program, which addresses measures for which the kW or kWh savings are known, to "pay for performance" contracts. This has led to a greater reliance on systems that can monitor and maintain building energy performance.

These systems will monitor, benchmark, report, manage responses, and store energy performance data. Several prominent ESCOs have built their businesses around such a "pay for performance" business model, including Seattle-based McKinstry, Ameresco, Johnson Controls, and Siemens Building Solutions.

The Pacific Northwest National Laboratory has also developed building energy performance tools. The Whole Building Diagnostician (WBD) is a modular diagnostic software system that provides detection and diagnosis of frequently encountered issues associated with the operation of heating, ventilating, and air conditioning systems in nonresidential buildings.[42]

Emerging Measures

Finally, there are key trends in specific measures or efficiency practices that constitute best practices. Two are discussed briefly below.

Daylighting

A recent report discusses the increasing sophistication and market share that daylighting gained in recent years. Don Aumann, at the California Lighting Technology Center has noted that designers are "…now specifying view windows separate from daylighting windows. Low windows let in less light and glare but still allow occupants to see out. Higher daylight windows get light into the interior of the building space. Light shelves and light louvers help transmit and diffuse light throughout the space."[43]

[42] California Best Practices Project Advisory Committee, *Energy Efficiency Best Practices: What's New?*
[43] California Best Practices Project Advisory Committee, *Energy Efficiency Best Practices: What's New?*

Commissioning

The importance of commissioning was mentioned above. In commercial energy-efficiency programs the process of building commissioning (and retro-commissioning), with its increasing focus on active building performance management, has become more prevalent. It was given a boost when the U.S. Green Building Council (USGBC) required commissioning as a pre-requisite for LEED certification for new commercial construction and major renovation projects. Recently, the California Commissioning Collaborative (CCC) was formed to bring together California utilities and state agencies to promote increased commissioning activities in the state. In 2009, the CCC initiated an effort to raise the profile with three state agencies: CPUC, Building Standards Commission, and the CEC.

In the past, including commissioning in Title 24 has been difficult because Title 24 requirements effectively end at the time of building occupancy and CEC policy requires that each measure included in Title 24 be cost-effective. For new construction, commissioning is a complex set of activities that cannot easily be reduced to a definitive set of benefit-cost data, and in many cases it is difficult to document errors or malfunctions that were avoided because of commissioning. However, Title 24 has taken initial steps toward requiring commissioning by including functional testing requirements. The recently-adopted CALGreen Standard does require commissioning for new nonresidential buildings greater than 10,000 square feet. CALGreen also includes energy monitoring as a voluntary measure. The CCC plans to advocate the inclusion of mandatory monitoring requirements in the 2011 version of Title 24.[44]

An initial survey of the commissioning providers, conducted by the CCC,[45] showed a substantial increase in this activity. The survey identified about 500 commissioning agents across the country, and 141 of them were interviewed. About two-thirds of their work was on new construction and one-third on existing buildings. Taken altogether, the study results suggest a significant growth trend for commissioning activities.

[44] California Commissioning Collaborative, *Commissioning Provider Survey: Requiring Monitoring in 2011 Title 24 Standards*, 4/2010 http://resources.cacx.org/library/HoldingDetail.aspx?id=509

[45] California Commissioning Collaborative, *Commissioning Provider Survey: Requiring Monitoring in 2011 Title 24 Standards,*

8. Conclusions and Recommendations

SCE's SBD Program has been successful in generating energy savings in the new nonresidential building market, reaching between 19% and 28% of the new floor space added each year from 2004 through 2008. For six categories of buildings, market penetration of the Program exceeded 20% over the period 2006 through 2008. Looking forward, SBD Program Managers have asked:

- Is there potential for further growth of SBD in sectors most actively participating in the past?
- What other sectors should SBD target to increase participation?

Prior studies of the Program have largely considered sectors to be buildings types and have focused on the participation of different building types in the Program. Given the complex nature of the nonresidential building market, and the significant recession and construction downturn, this study takes a broader view of the market to try to provide a more robust answer to these questions.

We have assembled information from multiple sources about the market—what factors drive energy-efficiency decisions, how the design/construction process affects decisions, and underlying trends in major market drivers—and examined their relationship to the SBD Program. The analysis starts with estimating the Program's historical market penetration rate overall, and by building type, based on consistent data for the Program and market. It then examines market characteristics and trends and relates them to the Program's objective of enhancing savings and market penetration.

Conclusions

The key conclusions from this study are presented below by major topic area.

SBD Program Market Penetration

Before examining what the likely directions would be in the nonresidential building market and how SBD could have greater impact on the market, it was important to establish how effective the Program had been in enrolling participating buildings. This study produced a method for calculating Program market penetration using consistent data and applied it to the Program over several years. The methodology uses floor areas of SBD completions and estimated completions across the entire SCE service area to determine penetration rate. Our analysis shows that the penetration rate has been fairly stable since 2004. Over the period 2003 through 2008, the lowest rate was 12% in 2003 and it has hovered at around twice that in the subsequent years. The highest rate was 28% in 2005.

By building type, the penetration rate tends to fall into three groups: those with low market penetration (4% or less); those with medium market penetration (11% to 17%); and those with a high rate (20% to 30%). Building types where penetration has been the least are mostly unusual types such as Amusement/Social/Recreational and Religious. The highest rates have been in Manufacturing Plants/Warehouses/Labs, Schools/Libraries/Labs, and Stores/Restaurants. The other categories with penetration rates over 20% are Government Service, Hotels/Motels, and

Warehouses (non-manufacturer owned). Buildings in the mid range include Hospitals/Other Health Treatment and Office/Bank.

We did not have data for 2009, but it will be important to update this analysis to see if market penetration remains relatively stable during the significant market downturn.

Factors Affecting Energy-Efficiency Decisions

Major factors that drive increases in energy efficiency in new nonresidential buildings (and renovations) include:

- Desire to reduce utility costs as a component of operating costs, particularly in the current market with higher vacancy rates
- Building energy codes (including the CALGreen code) and rating systems such as LEED—tighter codes, however, make it more challenging for programs like SBD to produce energy savings
- Sub-metering and tenant utility billing in multiple-tenant buildings so tenants have an incentive to reduce energy use
- Benefit-cost analyses based on energy modeling and economic analysis
- Desire to reduce greenhouse gas emissions
- Societal benefits and branding benefits

Key obstacles to investments in energy efficiency in nonresidential buildings include:

- Upfront costs, including energy modeling costs
- Capital constraints
- Lack of sub-metering in multiple tenant buildings
- More difficulty getting plans through review process

The decision to go above code requirements in a new building or in a renovation is ultimately based on the balance between the drivers and obstacles listed above and the perspective and preferences of key decision makers. Since producing an energy-efficient building smoothly and effectively is best done in a process that brings together the key stakeholders (such as owner, developer, architect, and builder) and integrates the steps required, from concept through construction, it seems a well integrated design-build process would be the most conducive approach.

The evidence, however, suggests that the energy efficiency of a nonresidential building is not very dependent on the process used to go from the concept phase through construction. Architects or A&E firms are commonly used to develop nonresidential building designs, which then go out to bid for construction. The integrated design-build process is less common. Though design-build presents the opportunity for a more integrated approach for incorporating energy efficiency in a building, the evidence and observations we documented suggest that the likelihood of increasing energy efficiency in nonresidential buildings is minimally dependent on whether a design-bid-build or design-build contracting process is employed.

Furthermore, whether a building is built based on a totally new design or a variation of a standardized design does not appear to be a significant determinant of its energy efficiency. There is sufficient evidence that standardized designs can be very energy efficient, and that "standardized designs" are actually often not very standardized and allow for significant fine-tuning to meet specific needs. We find this to be the case with renovations as well as new construction.

Our findings are mixed on whether building type inherently affects energy efficiency. Sources that did think efficiency was emphasized in certain building types identified these as the types that were likely to be built to be more energy efficient:

- Government sector buildings
- Academic facilities
- Data centers
- Large chain retail facilities

On the other side, those likely to emphasize energy efficiency the least included:

- Hospitality
- Small retail and malls
- Office buildings

Many respondents thought there was little difference in the energy efficiency of different building types, however. More than one respondent felt that the main issue is that the primary purpose of most buildings is to provide a specific service, and energy efficiency is a secondary concern as a driver of one of the operating costs.

The major determinant of the energy efficiency of new construction or renovation appears to be whether energy-efficiency goals are established by a key stakeholder early in the process. In general, the key stakeholder is the owner. However, there is evidence other stakeholders, including the developer, architect, or O&M staff, can be instrumental in decisions to build to high efficiency levels. In renovations, the facility manager or building engineer often push for energy efficiency improvements. Many large property management firms look for ways to improve efficiency in their properties and regularly make recommendations to building owners on what they should be doing to increase efficiency as well.

The influence of the ultimate building occupants on the energy efficiency of a building varies. When new facilities are "build-to-sell," the energy efficiency is often not a concern to the builder since the objective is to turn the building over quickly. In the current economic conditions, however, this type of project is quite rare. If the owner leases the building instead, the owner may choose to make it energy efficient, but owners often feel that prospective lessees are not very knowledgeable about or interested in energy efficiency. When a building is built for the owner to occupy, the chances are better that the design will be energy efficient. However, even in this case, the occupants who eventually physically occupy the space may not influence its energy efficiency if the decision making is done by a different entity or part of the organization.

The lease market is typically less likely to build energy-efficient buildings or do energy-efficient renovations. The main reason is the split incentive between owner and occupant and the situation depends on who pays the utility bills. Another reason is that there are typically more decision makers involved in leased buildings than in owner-occupied buildings. However, tenants are increasingly asking for energy-efficient or green renovations.

Trends

The most significant trend affecting the nonresidential construction market in Southern California is in the drivers that influence the demand for commercial floor space. Population and employment trends drive the need for floor space. Recent projections show that the most growth in employment in Southern California will be as follows by sector, starting with the sector with the most jobs added:

- Trade/Transportation/Utilities~1.28%/year[46]
- Education Services/Health Care/Assistance~2.35%/year
- Professional/Business Services~1.68%/year
- Leisure/Hospitality~1.48%/year
- Local Government~1.23%/year

Consequently, the growth in new floor space will likely follow a similar pattern. In the near term, there is an expectation that growth in floor space will be the largest in the government, medical, and education sectors. Office space and retail space construction are expected to be very limited. Most analysts expect that overall nonresidential construction spending will begin to trend upward in 2011.

The confluence of these trends and the economic conditions suggests that much of the construction that does occur will involve renovations of existing buildings. For example, the existence of older, less efficient large-format retail or warehouse/distribution spaces provides new territory for developers who choose to do renovations. Nevertheless, renovations will only be possible for developers who have access to financing. Renovations projects with the potential for the highest energy savings are the larger, more complex projects. Larger companies that have the potential for significant energy savings appear to be more likely to invest in renovations with larger savings, while a smaller company with limited access to upfront capital may not be able to justify the additional cost. Significant drops in construction costs—as much as 30% to 40%—will provide some impetus for renovations.

Increased concern about utility costs is another trend that has emerged from the economic downturn. In terms of energy-efficiency investments, reported planned investments in energy-efficiency improvements are forecast to increase by 5% to 9% over 2007 spending. As with renovations, large businesses are expected to be more likely than small businesses and organizations to invest in energy efficiency. Government and educational organizations are more likely than other sectors to invest in energy-efficiency upgrades and, as noted above, growth in

[46] Percent per year is the simple average of jobs added over 10 years based on a 10-year forecast.

floor space is expected to be relatively strong in these sectors. The retail sector is expected to lag significantly in terms of energy-efficiency investment

The most common energy-efficiency investments are expected to be in lighting. Efficiency upgrades in renovations are also expected to include variable frequency drives (VFDs) and HVAC replacements, though much less common than lighting upgrades. Plug load efficiency is another area that is being explored. Building owners and occupants are also expected to push behavioral changes (such as turning off lights).

Implications for Savings By Design Program and Savings Potential

The Program appears to have been most successful in enlisting larger organizations to participate, many of which also occupy the buildings they own. Our interviews provide evidence that these are the most likely candidates to invest in energy efficiency. Interviewees indicate that the administrative complexity of the Program has been an obstacle to participation by smaller firms. Given capital constraints it is probable that construction will shift toward smaller projects, so it is important to adapt SBD to the needs of such projects. SCE and other California IOUs have recognized this and have started to implement approaches to simplify participation of smaller projects.

Several findings point to the benefits of getting SBD involved earlier in projects, both new construction and renovations. It is possible to have more influence on the direction of a project through early involvement before substantial arrangements and decisions have been made. The challenge is finding ways to inform potential participants early enough about the Program, learn about future projects, and find points of entry. Again, SCE's SBD staff have recognized this need and taken steps to engage in projects earlier.

The largest Program energy and demand savings historically have been in stores and restaurants, warehouses, and schools. Even though large savings potential remains in these building categories, recent and expected trends in the mix of building types suggests that the Program will need to target other building types as well. Both the relative and, in some cases, absolute potential savings in government service, libraries, and healthcare-related buildings will increase as construction in the traditional segments declines.

Overall, the economic downturn has reduced the potential for Program energy savings. By 2011, additions to floor space are expected to decline significantly to just 32% of the 2008 quantity. The substantial decline in the amount of new floor space will clearly limit the total that the Program will be able to enroll. An increase in construction is expected in 2012, but the overall level is expected to stay depressed below the 2008 quantity. The immediate challenge will be to maintain recent market penetration levels in the declining floor space additions.

While total floor space additions are expected to decline dramatically, the shift in the mix of building types constructed is expected to mitigate the effects of the decline somewhat on maximum energy savings potential. The maximum savings potential is expected to decline to 35% of the 2008 level in 2011, and then increase to 47% in 2012 with the expected small construction rebound. Demand savings potential, on the other hand, is expected to decline slightly more than the decline in new floor space because the building type mix shifts toward buildings with lower demand savings to go along with their energy savings.

Table 16 summarizes key information about the various sector building types and potential savings for each. The table presents the gap between the maximum potential savings and the base potential savings over the period 2009 through 2012. The gap is a measure of how much Program savings could increase if the historical penetration rate increases to 100% and the gap percent (Gap %) is a measure of how large the gap is compared to the gap for the building type where the Program has had the largest penetration, i.e., penetration of 29% and a gap of 71% for Mfg. Plants/Warehouses/Labs. While Stores/Restaurants still have the largest potential for growth in terms of energy savings, Government Service, Warehouses (non-manufacturer owned), Schools/Libraries, and Hospitals/Other Health Treatment present very large potential savings too. The Gap % value is important because it indicates which building types have been underserved by the Program; building categories with values greater than the 28% average could be considered to be underserved.

Since the magnitude of potential savings and the Gap % are both important for purposes of targeting the Program, the table also presents a metric that combines these two. We first ranked each building type by its energy gap and its Gap %. The ranks were then added and each building type was ranked based on the sum of the rankings; the kWh rank and Gap % rank were weighted equally. The combined rank shown in the last column indicates how the building types rank when both metrics are taken into account. Based on these results, the best opportunities are in Hospitals/Other Health Treatment. They are followed closely by Stores/Restaurants, Government Service, Warehouses (non-manufacturer owned), and Parking Garages/Automotive Services, which are all tied using the combined rank. These four are listed in order of their energy savings gap. Parking Garages/Automotive Service is surprising and its rank results largely from the 96% Gap %, indicating that the potential in this category is largely untapped by the Program to date. Hotels/Motels and Manufacturing Plants/Warehouses/Labs are ranked lowest. Schools/Libraries/Labs unexpectedly are also ranked near the bottom because the historical penetration has been relatively high.

Table 16. Gap in Potential Savings, 2009-2012

Building Type	Gap, kW	Gap, kWh	Gap %	Combined Rank
Hospitals and Other Health Treatment	3,084	25,933,727	42%	1
Stores and Restaurants	15,691	66,796,228	20%	3.5
Government Service Buildings	3,949	50,205,212	25%	3.5
Warehouses (excl. manufacturer owned)	7,537	44,465,930	30%	3.5
Parking Garages and Automotive Services	733	6,656,479	96%	3.5
Office and Bank Buildings	2,230	12,236,483	62%	6.5
Amusement, Social and Recreational Bldgs	1,379	9,104,132	87%	6.5
Miscellaneous Nonresidential Buildings	1,834	15,969,181	30%	8.5
Religious Buildings	1,295	4,521,798	98%	8.5
Schools, Libraries, and Labs (nonmfg)	8,265	28,550,686	3%	10
Manufacturing Plants, Warehouses, Labs	2,656	16,179,887	0%	11
Hotels and Motels	994	3,649,266	31%	12
Total	49,647	284,269,009	28%	

Note: Combined Rank indicates rank when energy savings gap (kWh) and the Gap % ranks are combined with each weighted equally.

It is worth considering the demand impacts as well as energy savings. We note that three of the best candidates based on the combined ranking—Hospital/Other Health Treatment, Government Service, and Parking Garages/Automotive—receive relatively low rankings in terms of their demand gap (kW), especially when compared to their energy savings (by taking the ratio of the kWh gap and kW gap). On the other hand, Schools/Libraries/Labs are rated low based on the combined ranking, but this category has the second largest demand savings gap. Consequently, if SCE is primarily seeking demand savings then the rankings could vary from those if energy savings are of paramount importance.

Finally, this study has produced evidence from many sources that major renovations are likely to represent a growing share of the opportunities for the Program. Given insufficient information at this point on the extent of renovations occurring, it is difficult to determine how large the shift toward renovations is and will be. Nevertheless, the evidence is clear that renovations are filling a significant gap in the new building construction market and success of the SBD will be in part determined by its ability to target and recruit major renovation projects.

Recommendations

As indicated at the beginning of this report, the goal of this study was to answer specific questions about the market penetration of SBD to date and prospects for the future, and to more broadly gain insights into the nonresidential building market and how SBD can increase its effectiveness. The findings from this study provide the basis for several recommendations that respond to SCE's needs to position SBD to maximize its effectiveness, especially in the face of the major market downturn that is occurring.

Recommendations are presented in two sections. First, several analytic and data recommendations are identified that would support SCE's actions to ensure the continued success of the Program. Second, specific recommendations are provided for actions SCE can take to improve the effectiveness of the Program, several of them relying on the analytic and data recommendations.

Data and Analysis

Obtain demographics and other market data and projections: Population and employment trends in Southern California will drive the market for new buildings and renovations. We recommend staying current with the California Employment Development Department statistics and forecasts to understand the drivers of the nonresidential building market.

Obtain essential market construction data: We recommend that SCE continue to obtain data on the number, type, and square footage of new additions to the building stock completed each year. The Program market penetration analysis developed and presented in this study relies on these data, and tracking the Program's penetration in the aggregate and by building type will require consistent and current data.

Obtain essential market renovations data: Data were not available for this study to determine the actual magnitude of major renovations in the SCE territory in terms of dollar value or floor area affected. Given the current, and possibly future, growth in importance of this market activity it is essential for the success of the Program to quantify the size of this market and trends.

Perform market penetration analysis: The methodology we used to estimate Program market penetration relies on consistent data sets and analysis to provide an annual Program market penetration estimate and an internally consistent time series. This information is essential for assessing Program effectiveness and identifying opportunities for enhancements. The methodology should be expanded to include major renovations.

Conduct network analysis for the Southern California nonresidential building market: Information on market actors should be compiled and used in a network analysis to identify who the key players are and relationships among them. A successful network analysis could be used to assist SCE target Program outreach and maximize leveraging of its efforts to increase market penetration and impacts of the Program.

Estimate Program market potential: The method applied in this study provides insights into the segments in which the Program has been most successful and opportunities for Program targeting that could increase effectiveness. With the addition of data on renovations and further analysis, similar estimates could be developed for major renovations.

Program Enhancements

Continue to find ways to introduce SBD earlier in the planning and design processes: For both new buildings and renovations, Program participation is likely to increase if Program intervention can occur earlier in the process. SCE has recognized this need and taken steps in the Program approach to move its involvement further upstream. Our research confirms the necessity of doing this and indicates the importance of continuing to intervene early in the development process. This is, of course, a challenge since SCE does not always have knowledge early enough to recruit participants; this is especially challenging with major renovations.

Leveraging the market actor network the Program has developed is a place to start. Other possibilities are working closely with local government entities that may know about coming projects, interfacing with private sector services (such as Reed or McGraw Hill) that track similar information, or expanding outreach to the building community.

Whether a project uses a design-build or design-bid-build approach, or some alternative, is less material to the opportunities for increasing energy efficiency than early Program involvement. For design-build projects, the Program needs to provide input to the solicitation used to select a design-build team. In this case, it needs to target the owner or the contractor selected to develop the solicitation. For projects where the design phase is conducted separately, the Program can be introduced through the owner, developer, or architect/designer. For major renovations, the Program can be introduced through numerous different channels such as the occupant, building manager, facility engineer, or building owner. In general, the Program needs to reach out to market actors who have a significant role in the design decision-making process, and they vary depending on the nature of the project, the contracting approach used, and ownership/occupancy.

Engage with local building and planning departments to maximize opportunities to increase energy efficiency and minimize barriers: One way the Program can influence the earliest stages in development is to work with local government entities responsible for planning. Flexibility to increase energy efficiency can be constrained by local regulations and requirements or not taken into account. Informing local planning and building officials about the benefits of energy efficiency in new and existing buildings and tackling regulatory impediments can increase the ways in which energy efficiency can be increased through SBD. Leveraging the Sustainable Communities program may be one approach.

Similarly, the Program should work with both designers and building officials to facilitate the approval of possibly uncommon efficiency measures and equipment. This could help reduce review time or the probability of rejecting desirable measures.

Use information from this study to help target the Program to key building types: One way to select building types to target is to choose categories based on both the largest energy savings potential and the largest market penetration gap so far. The top five building type candidates applying this combined criterion are:

- Hospitals/Other Health Treatment
- Stores/Restaurants
- Government Service
- Warehouses (excluding manufacturer owned)
- Parking Garages/Automotive Services

If demand savings are a priority, then Schools/Libraries/Labs would be included in the priority categories.

Based on our analysis, the building types that would be the lowest priorities for future Program efforts are Hotels/Motels and Manufacturing Plants/Warehouses/Labs.

In new construction, target building owners: Because owners have the most influence on decision-making, the Program should step up efforts to market the Program to owners. The business case for increased energy efficiency needs to be made convincingly and early in the process.

Expand recruitment of major renovation projects: Interviewees and the literature reviewed for this study emphasized the significant trend toward major renovations in existing buildings in lieu of new construction. In some cases, these renovations occur in leased space (see next recommendation) and in other cases they occur in buildings under the existing or a new owner. In the case of renovations initiated by an owner, early involvement by the Program is essential. As with new construction, the business case needs to be made to the owner. Though more difficult to identify than new construction, SBD Program staff should be able to get early information pending opportunities from components of the utility involved in economic development or from customer representatives.

Design and implement approaches to increase participation of leased space: For leased space, marketing to recruit participants should target not only owners, but also property managers, facility managers and building engineers, and real estate agents. Key elements in a program targeting tenants and their tenant improvements or major renovations should include:

- Encouraging sub-metering so tenants are aware of and pay their utility bills
- Providing incentives to invest in specified energy-efficient tenant improvements
- Linking to an SCE program for retrofits and interior improvements, so that the incentive can be designed to address both the owner and the lessee
- Containing specific educational components to address the special needs of tenants and provide state-of-the-art information about new technologies and interior treatments

Explore ways in which the Program can provide decision makers with credible energy savings and cost estimates: Decision makers need reliable information on the energy and cost impacts of alternative energy-efficiency investments. However, conducting a range of energy analyses can be expensive. The Program should examine ways to cover the expenses of energy analyses or provide energy analysis services to potential participants.

Communicate the range of benefits of participating in SBD: Program materials, education, outreach, and interactions with potential participants should stress not only the energy savings, but the reduced operating costs over the life of the building or space; environmental benefits and sustainability; urgency of the need to reduce energy consumption; and the competitive advantages energy-efficient space offer in the market as businesses continue to look for ways to trim costs and become more environmentally conscious. The messaging also should take into account recent decreases in construction costs. These messages should be prevalent in recruiting building owners, developers, renters, and the full range of potential participants and decision-makers.

Continue to simplify the participation process for smaller projects and renovations: SCE has recognized the need to simplify the participation process and developed simpler tailored approaches. The success of these approaches should be evaluated and modified and expanded, as appropriate, to help increase participation.

Meet special needs of retail participants: Energy efficiency has the potential to conflict with the image retailers may perceive they need to project to lure customers. Excessive air conditioning, open doors, and high illumination are examples. The Program should focus on ways to provide an attractive "climate" using a variety of approaches that optimize "walk-in" traffic at the lowest marginal expenditure of energy. Steps that can be taken include:

- Provide educational programs to inform about energy-efficient alternatives
- Offer incentives tied to more efficient facility operation
- Provide state-of-the-art solutions for lighting, HVAC operation, window treatment, store configuration, etc. leveraging best available technologies
- Provide highly visible recognition to businesses that participate

Develop specific approaches to involve public sector buildings: The Program should recognize the special needs of the public sector, particularly given the likely near-term growth in this sector. Specific options include: technical assistance; access to state-of-the art energy-efficiency equipment, fixtures, and building management systems; and engineering help to integrate emerging new technologies into the development plans for new construction and recommissioning for major renovations. Another area of interest to this sector may be creative approaches that can be used to provide financing for projects "off the budget." Also, given that decision-making for public sector buildings is likely to be centralized and involve personnel who do not occupy the space, it is important to understand the decision-making process and identify the decision-makers and work with them to influence participation in the Program.

Explore the range of new financing options and how they might complement the Program: Chapter 7 identifies several innovative financing mechanisms that could help overcome the funding barriers faced by potential participants. Given the current economic situation, creative financing solutions may be more critical now than ever.

Appendix A. Penetration Rate Calculation

Market penetration is simply the ratio of the square feet added to the building stock in the Savings By Design program to the total building stock additions in SCE territory. SCE keeps good records of buildings that have participated in the Program; however, estimating the additions to building stock in the SCE territory is relatively difficult.

SCE supplied two files, one with building SBD participating building information and another with the floor area in square feet (SQFT) information for those buildings. These were “Final 2000-2006_2008.xls” and “Final SQFT 200-2006_2008.xls”. Itron supplied the 2007 building information that was used in the previous study (a file labeled SBD – 2007 activity.xls).

We used the incentive approval date to classify the project year for each SBD building. However, the incentive approval date has only been consistently populated by SCE for 2007 and 2008 projects. For the earlier years we determined incentive approval date by verifying that the “Detailed Status” field reflected “complete AP status” and then using the “Redeem Date” value as the incentive approval date.

Total completions by zip code for the 10 counties served by SCE were provided by McGraw-Hill Construction. The completions specific to SCE’s territory were determined by restricting the McGraw-Hill Dodge Data to only those zip codes in SCE’s territory. There is likely to be a small error in this count due to some zip codes being served by more than one utility, but there was no way to determine the share of buildings within a zip code that fell into the service area of another utility. The list of zip codes was supplied to Cadmus by SCE.

We then calculated market penetration by dividing the SBD floor area additions each year by the total completions floor area (Dodge Data) for each year.

Appendix B. Floor Area Completions in SCE Service Area

The following table presents estimates of floor area of nonresidential buildings added by county in SCE's service territory, by year, in thousands of square feet. Values for 2010 through 2012 are projections.

McGraw-Hill Construction Data Estimated Completions [Restricted by Zip Codes]

County	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
INYO, CA	59	9	.	4	4	41	-	8	78	37
KERN, CA	2,716	4,449	825	884	1,039	1,527	939	432	585	732
LOS ANGELES, CA	25,266	21,348	22,680	20,723	21,195	20,536	18,122	8,795	8,473	11,607
MONO, CA	144	38	48	335	77	-	-	9	19	33
ORANGE, CA	8,123	6,406	7,745	11,840	13,889	10,310	4,691	3,949	4,429	4,584
RIVERSIDE, CA	10,216	12,145	12,183	13,956	13,871	14,037	9,481	4,490	3,037	4,869
SAN BERNARDINO, CA	16,924	15,660	18,067	16,925	16,226	24,321	10,796	5,468	4,356	5,037
SANTA BARBARA, CA	366	1,045	1,131	992	1,407	420	297	634	227	468
TULARE, CA	1,281	975	823	1,261	1,950	2,502	1,338	371	721	779
VENTURA, CA	3,606	3,269	4,164	1,375	1,515	1,102	2,488	1,290	884	1,067
TOTAL NON RESIDENTIAL	68,699	65,345	67,667	68,295	71,174	74,796	48,153	25,446	22,810	29,211
Ratio SCE Territory to 10 Counties	87%	85%	87%	87%	87%	87%	86%	85%	85%	84%

Project Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Amusement, Social and Recreational Bldgs	1,766	2,731	2,484	2,087	1,830	1,657	1,479	693	1,328	1,709
Dormitories	488	395	615	289	903	115	502	1,332	626	786
Government Service Buildings	2,141	2,451	857	650	880	1,006	949	698	1,517	1,716
Hospitals and Other Health Treatment	1,972	3,340	2,988	2,365	2,736	3,567	2,811	2,730	2,075	1,805
Hotels and Motels	1,794	1,286	1,196	1,607	2,956	2,864	1,287	574	571	647
Manufacturing Plants, Warehouses, Labs	2,110	1,819	3,936	3,128	1,805	4,493	1,741	1,108	562	832
Miscellaneous Nonresidential Buildings	438	587	397	848	721	230	586	1,405	1,175	2,068
Office and Bank Buildings	6,887	5,025	5,537	6,861	9,454	8,161	3,285	1,079	1,334	1,813
Parking Garages and Automotive Services	7,701	6,333	8,301	11,200	11,975	10,138	7,142	2,748	3,099	4,209
Religious Buildings	723	672	533	1,038	992	624	513	445	807	606
Schools, Libraries, and Labs (nonmfg)	5,676	7,700	9,212	6,069	6,026	6,851	6,521	6,916	3,692	4,660
Stores and Restaurants	11,399	11,122	9,813	11,708	9,989	12,753	9,424	2,368	2,703	4,050
Warehouses (excl. manufacturer owned)	25,604	21,885	21,799	20,445	20,906	22,339	11,913	3,352	3,320	4,311
TOTAL NON RESIDENTIAL	**68,699**	**65,345**	**67,667**	**68,295**	**71,174**	**74,796**	**48,153**	**25,446**	**22,810**	**29,211**