NAVIGANT

Savings By Design Market Potentials, Characterization and Best Practices Enhanced Program Participation Study

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February 7, 2014

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Executive Summary

Introduction

The Savings by Design (SBD) program is the major energy efficiency program offered through California's Investor Owned Utilities (IOUs) that aims at transforming the non-residential new construction market toward energy efficiency. The SBD program promotes energy efficient building design and construction by offering design and financial assistance rewarding those non-residential buildings which go above the minimum standard set by California's Title 24 code. The program is funded through the Public Purpose Programs surcharge which is applied to both gas and electric services throughout the state of California. IOUs participating in this study include:

- Pacific Gas and Electric (PG&E)
- San Diego Gas and Electric (SDG&E)
- Southern California Edison (SCE)

The primary goal of this study is to provide SBD program managers with the information they need to enhance program participation. This is accomplished by updating and enhancing the research conducted in a *2011 SCE SBD study*[1]. The current investigation updates the work for the SCE territory, replicates the earlier study methodology across both the PG&E and SDG&E territories, and provides enhanced analysis of best practice approaches to increasing program participation.

Key Findings and Conclusions

Program Market Penetration and Potential

Historic market penetration and savings potential were determined for each of the California IOUs, with the goal of determining the two market sectors with the highest savings potential for each IOU. Table 1 provides an overview of historical market penetration for all building types and shows that participation as a percentage of new floor space has varied year to year.

[1] CADMUS. *Commercial Building Market Characterization for Savings by Design Program*. June 20, 2011-- In this 2011 SCE SBD study, research was conducted within the SCE territory to examine building category subtypes, ownership typologies and project design and construction processes to reveal characteristics about the commercial building market that could be used by the SBD program to increase participation. The 2011 SCE study included an analysis of program penetration from 2003-08 and characterized the energy savings market potential by owner and building type to support strategic energy planning.

Table 1: Savings By Design Participation Rate[2] by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
PG&E Participation Rate	11%	15%	13%	34%	15%	6%	3%
SDG&E Participation Rate	6%	16%	16%	12%	26%	5%	41%
SCE Participation Rate	14%	12%	14%	15%	16%	12%	9%

Source: Navigant Analysis

Navigant combined the future savings potential, as defined in *Section 1.3.1 – Future Savings Potential*, into a single metric which each IOU can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric, demand, and gas savings respectively for each building type. Next, these percent values were averaged to come up with a composite value. The top building types for each IOU are shown in Table 2.

Table 2: Savings By Design Future Potential, Building Types by Rank and IOU

			2013-15 Remaining Potential			2013-15 Score (Percent of total future potential savings)			
IOU	***Rank***	***Building Type***	***MWh***	***MW***	***MTherm***	***MWh***	***MW***	***MTherm***	***Average Percent[3]***
PG&E	1	Office and Bank Buildings	254,857	37	5,959	32%	18%	41%	30%
PG&E	2	Stores and Restaurants	194,689	46	456	24%	23%	3%	17%
SDG&E	1	Manufacturing Plants, Warehouses, Labs	23,317	5	545	9%	7%	51%	23%
SDG&E	2	Schools, Libraries, and Labs (nonmfg)	28,943	15	281	11%	21%	27%	20%
SDG&E	3	Stores and Restaurants	92,493	22	-110	35%	31%	-10%	18%
SCE	1	Stores and Restaurants	262,970	52	0	33%	29%	0%	31%
SCE	2	Schools, Libraries, and Labs (nonmfg)	103,648	32	0	13%	18%	0%	16%

Navigant interviewed subject matter experts on how to best influence each of the building types identified in Table 2. Recommendations are presented in *Section 5.5 – Barriers and Solutions to Savings By Design Priority Buildings*.

[2] The Participation Rate is defined as completed SBD projects determined from the SBD tracking database at year end as a percentage of total building construction within each IOU.

[3] The Average Percent score is meant only as a ranking to compare building type potential. Because savings technologies are different between electricity, demand and gas this value is not meant to indicate absolute potential or recommend potential technologies to explore.

Market and Economic Trends

Navigant investigated national and California based market and economic trends by investigating census data, American Institute of Architects (AIA) building indices and California's Employment Development Department's (EDD) employment forecasts. Major findings include:

- From 2008 to 2012, the renovation sector was the highest grossing sector of the California non-residential construction market, as discussed in *Appendix B – Construction Monitor Methodology and Data*. Current economic conditions have increased major renovations of existing facilities as an alternative to new construction – frequently repositioning them for different industry use (e.g., big box retail stores being renovated as healthcare facilities). SBD should ensure it is fully prepared to take advantage of opportunities in this area.
- Positive economic indicators, including a stock market rebound, gross domestic product (GDP) recovery and payroll employment increases, suggest a slow, steady growth in nonresidential construction starts. For more information refer to *Appendix C – Economic Analysis.*
- By considering the employment sectors with relatively robust growth, one can qualitatively infer which building sectors are likely to need new building stock. The *Professional and Business Services* sector is projected to have the largest growth across all of the three IOU service areas. Additionally, both new and re-purposed space is likely to be needed in the *Healthcare* sector and considerable growth is projected *in Leisure and Hospitality*.

Analysis of employment sector growth for each of the IOUs is discussed in *Section 4.3 – Industry and Employment Data by Service Territory.*

Factors Affecting Energy-Efficiency Decisions

Many elements influence whether a design team participates in SBD and how successful a design team is in achieving comprehensive savings. Generally speaking, most buildings are primarily influenced to some degree by the items listed in Table 3.

Table 3: Primary Drivers and Barriers to Energy Efficiency in California

Drivers	» Achieving a green or efficient certification and the associated positive marketing » The potential to receive incentives for both the owner and the design team » Saving on the lifecycle cost of ownership
Barriers	» The cost of the energy efficient measure, developing an energy model and undertaking a more detailed design » The complexity of the program and the need for participant education of the process » Serving the needs of accelerated design processes such as Design/Build projects, small and medium projects or "non-standard" buildings

Based on interviews with building owner representatives, key design team market actors, and national subject matter experts, SBD across California is addressing the drivers and barriers through a combination of sound marketing and outreach, market education, progressive incentives and exemplary technical support at the individual project level. However, SBD has focused on large buildings defined by long design periods and relatively generous design budgets. To fully penetrate the market potential SBD needs to have a more flexible program process that can mimic the design process and pace of other

design approaches present in the market. The Design/Build process characterized by accelerated design timeline and short decision windows should be a key area of focus.

Conclusions and Recommendations

Navigant project staff offer the following conclusions and recommendations for consideration by SBD Program Mangers. Following the findings noted in Table 3 Navigant has based conclusions and recommendations from a combination of a literature review, Navigant's expert determinations and in-depth interviews with California market actors as well as national subject matter experts. A high-level overview is presented in Table 4.

Table 4. Navigant Conclusions and Recommendations for Savings By Design

Recommendations	Supporting Findings
Marketing & Outreach	
» **When discussing savings with participants emphasize Return on Investment (ROI) or Lifecycle analysis instead of simple payback so that efficiency can be treated as any other investment opportunity.**	Interviewees discussing EE measures in terms of simple payback
» **Develop marketing and outreach materials teaching owners that even measures with longer paybacks are often sound investments.**	Interviewees looking for 4-6 year payback for EE measures
» **Continue to focus on market actors with marketing and outreach.** » **Highlight value to design teams with design team incentives, design charrettes, and potential for award recognition.** » **Provide data on how efficient design capability provides a competitive advantage.**	Market Actors such as Architects, Mechanical and Electrical Designers, and General Contractors are primary drivers of whether a project enrolls in SBD
» **Attend and present at trade meetings such as AIA and ASHRAE or conferences.** » **Consider hosting a trade conference focusing on energy efficient design and construction.** » **Continue to sponsor substantive events such as Architecture at Zero, a Zero Net Energy Design competition[4] integrating emerging technologies with innovative design/build alternatives.**	Design team members respond favorably to educational and networking opportunities
» **Seek out opportunities to publically promote building community achievements such as at a conference.**	Building owners and design teams are highly motivated by awards and green certifications
» **Consider having dedicated Efficiency Account Managers and Efficiency Technology Leads.** » **Consider a pilot program where SBD staff embeds with a handful of large design firms to promote market transformation.**	Other new construction programs are finding success proactively engaging top design firms and the largest customers
Program Design	

[4] Architecture at Zero is an annual design competition administered by PG&E. More information on the design competition can be found at http://architectureatzero.com/.

Recommendations	Supporting Findings
» **Provide alternative paths to participation that can work with different design team requirements, such as:** - **Leverage existing ASHRAE design guides to assist medium complexity buildings or those using a Design/Build process.** - **Offer a list of prescriptive measures for small, simple buildings, separate from the systems based prescriptive approach already offered.**	SBD focuses on projects with significant design budgets and struggles to work with projects moving at fast pace
» **Investigate the possibility of offering for gut-rehab projects a zero-down financing option where the debt obligation after incentive is lower than energy savings.** » **Consider offering financial assistance for energy modeling.**	Projects have difficulty changing the budget once set to include more design time or higher levels of efficiency
» **Retain robust design team incentives and design charrettes.**	Design team incentives are highly motivational for design team members
Program Implementation	
» **Seek out efficiencies in the program requirements, such as:** - **Empowering SBD staff to have flexibility in how the program is administered to fit participant's needs.** - **Determining each design team's goals early and customizing technical support and incentives.**	Design Team members generally feel SBD process is slow paced and requires a significant number of submittals
» **Retain SBD technical advisors and project managers as market is complicated and requires a multi-year commitment.**	Technical assistance of SBD is following best practices and is general appreciated by building owners
Green Certifications & Zero Net Energy	
» **Accelerate the market transformation by offering a pilot program with increased incentives and technical support in exchange for commitments from the building owner, such as:** - **Installing cutting edge technologies not yet proven in the marketplace.** - **Agreeing to third party ZNE verification, similar to the certification offered by the Cascadia Green Building Council.**	Zero Net Energy (ZNE) buildings are likely to increase in the near future
» **Focus ZNE efforts on improving the design process, rather than just strictly focusing on ZNE goals.**	ZNE is driven primarily by collaborative design rather than by individual technologies
» **Do not strictly require a ZNE result to participate in a ZNE pilot. Instead offer a path towards ZNE, refer to *Section 5.4.2* for more detail on what this might look like.**	ZNE is more difficult to reach in certain types of buildings
» **Reduce perception of risk by providing proven examples of successful ZNE projects.**	Targeting ZNE is perceived as risky in the California market

1. Introduction & Methodology

1.1 Program Overview

The Savings by Design (SBD) program is the major energy efficiency program offered through California's Investor Owned Utilities (IOUs) that aims at transforming the non-residential new construction market towards energy efficiency. The SBD program promotes energy efficient building design and construction by offering design and financial assistance rewarding those nonresidential buildings which go above the minimum standard set by California's Title 24 code. The program is funded through the Public Purpose Programs surcharge which is applied to both gas and electric services throughout the state of California. IOU's participating in this study includes:

- Pacific Gas and Electric (PG&E)
- San Diego Gas and Electric (SDG&E)
- Southern California Edison (SCE)

The SBD program is integral to California's ability to achieve the greenhouse gas reduction goals outlined in Assembly Bill 32 (AB32)[5] and helps prepare the market for more stringent Title 24 codes in future code upgrade cycles. The program's "new construction" definition extends beyond just new buildings; it includes major tenant improvements, the addition or expansion of an existing building or site footprint or the addition or removal of a load.[6]

1.2 Study Overview

The primary goal of this study is to provide SBD program managers with the information they need to help enhance program participation. This is accomplished by updating and enhancing the research conducted in the 2011 SCE SBD study[7]. The current investigation updates the work for the SCE territory, replicates the earlier study methodology across both the PG&E and SDG&E territories, and provides enhanced analysis of best practice approaches to increasing program participation.

Navigant Consulting, Inc. (Navigant) undertook the study in two phases. Phase I focused on updating the key elements of the 2011 SCE SBD study and developing enhanced study analysis for PG&E and

[5] In 2006 California passed Assembly Bill 32 (AB32) which set 2020 greenhouse gas emissions reduction goal into law. The goal is to reduce greenhouse emissions by 2020 to 1990 levels, or 427 million metric tons of carbon dioxide equivalent. More information is available at http://www.arb.ca.gov/cc/ab32/ab32.htm.

[6] A detailed definition of "new construction" can be found in the SBD Program Handbook at http://www.savingsbydesign.com/book/savings-design-online-program-handbook#booknode-437.

[7] CADMUS. *Commercial Building Market Characterization for Savings by Design Program*. June 20, 2011-- In this 2011 SCE SBD study, research was conducted within the SCE territory to examine building category subtypes, ownership typologies and project design and construction processes to reveal characteristics about the commercial building market that could be used by the SBD program to increase participation. The 2011 SCE study included an analysis of program penetration from 2003-08 and characterized the energy savings market potential by owner and building type to support strategic energy planning.

SDG&E[8]. The Phase II work included interviewing market experts to determine the best approaches to reach the market sectors identified as having the highest Future Savings Potential for each IOU, as addressed in task 6.

1.3 Methodology

The overall goal of Phase I was to build upon and update the work completed in the *2011 SCE SBD Study* to determine updated market characteristics and future savings potential, defined in *Section 1.3.1 – Future Savings Potential,* for the three IOUs participating in the study. Navigant improved upon the methodology from the *2011 SCE SBD Study* by taking into account existing building renovation activity and reporting results at the county level. Navigant also provided additional contextual discussion of the remaining potential by building type and design type. Utilizing this expanded methodology, Navigant completed the following analysis during Phase I.

1. A calculation of program market share by building type and IOU service territory.
2. A gap analysis to determine Future Savings Potential, following the methodology developed in the previous SCE report.
3. Interviews with key market actors including owner representatives and design team participants.
4. A market characterization analysis analyzing key factors driving SBD.
5. Evaluation of the effectiveness of new incentives, offered in the new program cycle.

Expanding upon the work completed in Phase I, Phase II targeted the two market segments for each IOU with the highest Future Savings Potential. To best understand the barriers and opportunities related to each of the key markets identified in the gap analysis, interviews were conducted with utility program managers from leading programs across the United States (U.S.) and industry experts with intimate knowledge of key markets. A literature review was also undertaken to evaluate options for reaching the priority, sometimes hard-to-reach, market sectors identified in Phase I, including Design/Build buildings, Medium to Small-scale buildings, and Leased buildings. Through the interviews and literature review, Navigant was able to recommend a set of best practices to be leveraged by California's IOUs in reaching out to these key market sectors with the ultimate goal of increasing program participation.

1.3.1 Future Savings Potential

The analysis of SBD potential relies upon the calculation of Future Savings Potential (also known as the Savings Gap). As illustrated in Figure 1-1, the Future Savings Potential represents the maximum additional savings that SBD can achieve beyond its current business-as-usual activity. The Future Savings Potential is not a "market" potential as commonly defined in energy efficiency potential studies,[9] but is more comparable to "economic potential" as commonly defined in energy efficiency

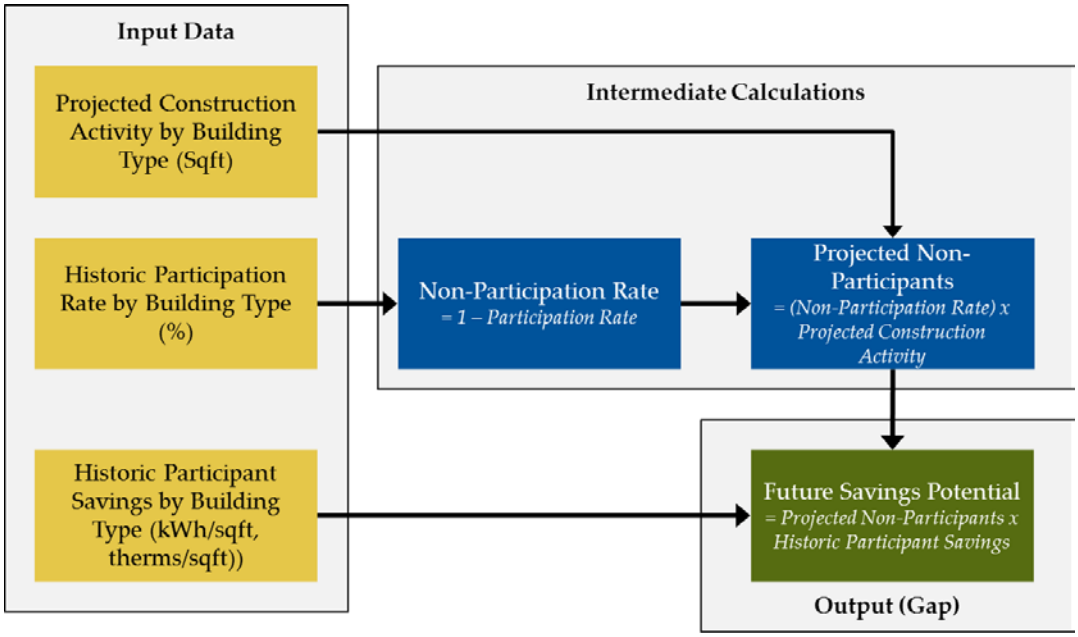
[8] Tasks for this study include (Tasks 1-3) development of a potentials and gap analysis for each IOU program; identification of priority SBD markets for expanding the program effort; (Task 4) a market characterization study; (Task 5-6) best practice market research and recommendations for approaching priority markets.

[9] A market potential analysis calculates the energy efficiency savings that could be expected in response to specific levels of utility incentives and assumptions about market influences and barriers.

potential studies.[10] The Future Savings Potential is calculated on an annual basis for 2013, 2014 and 2015 and is meant to represent the total maximum remaining savings potential if every single eligible non-participant participated in the program. Thought was given as to how to adjust the Future Savings Potential for the new T-24, 2013 code; however multiple data complications prevented this analysis. Further discussion of these inconsistencies can be found in *Appendix E- Future Potential Sensitivity Analysis.*

Future Savings Potential is estimated by multiplying the number of projected non-participants by the estimated savings per participant. Savings per participant ("Participant Savings by Building Type" in Figure 1-1) is calculated by analyzing historic program participation data. The number of projected non-participants ("Projected Non-Participants" in Figure 1-1) depends on the projected future construction activity as well as an estimate of the non- participation rate (informed by the Historic Participation Rate). The methods used to estimate Projected Construction Activity, Historic Participation Rate, and Participant Savings are documented in the following discussion of methodology.

Figure 1-1: Calculation Methodology for Future Savings Potential



Source: Navigant 2013

1.3.1.1 Projected Construction Activity

Projected Construction Activity is defined as the total commercial floor space that is expected to be constructed and is eligible to participate in SBD. While the SBD program focuses on new construction projects, program participants are not limited to new construction buildings; major renovations of commercial buildings are also eligible for the program. Navigant's analysis of Projected Construction

[10] An economic potential analysis calculates the total energy efficiency potential available when all cost-effective measures are installed by all eligible customers.

Activity includes both *new construction and existing building renovations*. For a detailed accounting of how new construction and existing building renovation activity was determined, see *Appendix D – Construction Activity*.

Construction is measured in terms of commercial floor space in square feet (sqft) rather than number of commercial buildings. To support a detailed regional sub-market analysis, all construction activity data was documented at the building type and county level within each IOU. The building types used in this analysis, as listed below, are consistent with similar previous analysis conducted for the SBD program.[11]

- Amusement, Social, and Recreational Buildings
- Dormitories
- Government Service Buildings
- Hospitals and Other Health Treatment
- Hotels and Motels
- Manufacturing Plants, Warehouses, Labs
- Miscellaneous Nonresidential Buildings
- Office and Bank Buildings
- Parking Garages and Automotive Services
- Religious Buildings
- Schools, Libraries, and Labs (non-manufacturing)
- Stores and Restaurants
- Warehouses (excluding manufacturer owned)

1.3.1.2 Historic Participation Rate

Historic participation rate is calculated by dividing the total floor space of SBD participants by the estimated program eligible floor space of commercial buildings. This analysis was performed at the IOU, building type and program year level; it was not calculated at the county level as limited data at this level of granularity would not provide reliable results. For the purposes of this analysis, Navigant assumed the average calculated participation rate from 2006-2012 by IOU and building type applied equally to each county within each IOU from 2013-15, as illustrated by the equation below.

$$Participation\ Rate = \frac{\sum_{2006}^{2012} Sqft\ of\ SBD\ Participants}{\sum_{2006}^{2012}(New\ Construction + Existing\ Building\ Renovation\ Eligible\ Floorspace)}$$

While this calculation seems simple and straightforward, data gaps for certain utilities required minor modifications to the methodology. These slight modifications are described in *Section 3 – Program Market Penetration and Savings Potential*.

[11] CADMUS. *Commercial Building Market Characterization for Savings by Design Program*. June 20, 2011.

1.3.1.3 Participant Savings

Participant savings are calculated by dividing the total SBD program savings by the total floor space of SBD participants. This analysis was performed at the IOU and building level; it was not calculated at the county or program year level as limited data at this level of granularity would not provide reliable results. Savings were expressed in kWh/sqft, kW/sqft and Therms/sqft. For the purposes of this project, Navigant assumed the average participant savings from 2006-2012 by IOU and building type applies equally to each county within each IOU from 2013-15, as illustrated by the equation below.

$$Participant\ Savings = \frac{\sum_{2006}^{2012} SBD\ Energy\ Savings}{\sum_{2006}^{2012} Sqft\ of\ SBD\ Participants}$$

1.3.1.4 Sensitivity Analysis

Navigant attempted to conduct a sensitivity analysis on the future potential for the SBD program. However, data gaps and alignment issues prevented such an analysis. *Future Potential Sensitivity Analysis* explains the original plan and the difficulties encountered.

1.3.2 Market Characterization

In developing an enhanced characterization of the commercial building market, Navigant conducted sets of interviews with utility program managers, design team members and building owners/developers. Design teams and owners/developers interviewed were selected from a pool of past program participants. Navigant conducted a common interview approach for each IOU to gather the needed information; however Navigant did not conduct additional market actor interviews in SCE territory, instead leveraging the *2011 SCE SBD Study*, which provided a baseline characterization for SCE's electric customers.

Navigant's team reviewed interview guides and questions used in other, similar reviews and developed a set of questions which addressed the key issues of interest to SBD, building upon the interview topics from the *2011 SCE SBD Study*. Specifically, Navigant included three additional lines of inquiry not fully addressed in the prior study:

- ***Industry Network Interactions*** – Network interaction information enabled additional analysis into motivations and drivers for various market actors. Navigant has found that understanding industry network interactions enables valuable reflection on the successes and failures of Non-Residential New Construction (NRNC) programs.
- ***Variation in Barriers/Enablers Due to Building Complexity and Design/Build Process*** – Conventional NRNC studies typically focus on building type or ownership patterns to provide useful analysis of drivers and barriers to participation. Navigant added the dimension of design process and building size/complexity to look deeper into drivers and barriers of the SBD process. By viewing the data differently SBD program managers will be able to glean new and valuable information on the varying levels of success in each category, and how to best reach new customers.
- ***Program staff and incentive effectiveness*** – Learning about the SBD process and the experiences of design teams and owners/developers on their experiences allowed for insight into the effectiveness of SBD to educate and transform the market. These program details will be critical for the transition to Zero Net Energy (ZNE).

Interviews were conducted with staff from each of the contracted utilities, SCE, SDG&E and PG&E. Sacramento Municipal Utility District (SMUD) staff was also interviewed as to their knowledge of the program and the market. They were also able to provide further insight in support of the IOU utility perspective. The utility staff interviews focused on the current structure of the program and future program goals. Additionally, the Navigant team explored features related to defining the Design/Build project delivery methods, and how these methods work with SBD and within the new construction market.

Once the program design, goals and strategies were better understood, the research team conducted interviews with design team members and building owners/developers that had a history of participating in SBD. The interviewees were chosen through a process of evaluating Construction Monitor data for permits pulled[12] in the IOU territories since 2008. This process ensured that interviewees were not only very familiar with SBD but also chosen from a variety of design teams and building developers, from large companies to smaller firms. By choosing those familiar with the program the quality of responses were higher, but there was not an opportunity to directly assess the barriers of someone new to the program. The breakdown of interviewees is shows in Table 1-1 below.

Design team member interviewees were comprised of project coordinators and executive level managers. The companies were very established, with some having been in business for over 35 years. Of the five companies interviewed one represented a local firm than specialized in small public sector buildings, two were statewide firms of a few hundred employees each with a wide range of services for medium sized buildings, and two were national firms that work with large complex buildings including data centers, universities, casinos, etc. All design teams had an engineering focus and most were not involved in the architectural design.

The owner/developers were comprised of two local school districts with multiple buildings ranging from 20,000 to 85,000 square foot buildings; one campus with multiple buildings ranging from 20,000 to 100,000 square feet; one national company with data centers and office buildings; and one national developer w a very large governmental building project. All the interviewees have been very active constructing new buildings within the last 10 years.

Table 1-1: Phase I Interview Subjects

Interview Groups	Number Interviewed
Program Mangers	4
Design Team Members (architects, engineers, contractors)	5
Building Owner/Developer	5
Total	14

The interview guides were organized to prioritize the important questions and maximize study outputs. The study outputs aim to recommend enhancements to SBD recruiting marketing approaches

[12] See *Appendix B – Construction Monitor Data & Methodology* for more information about this process.

including tools, techniques and implementation processes to the SBD program managers. The Navigant team used question-filters and importance hierarchies, as indicated in Table 1-2 to focus the interviews on "Tier One" priority questions, "Tier Two" and "Tier Three" questions, as appropriate.

Table 1-2: Interview Questions

Tier	Research Questions	CA Program Managers/Staff	Program Participants	Non-CA Program Managers/Staff	Industry Experts
One	**SBD:** Options for leveraging other [insert IOU name] programs to increase SBD savings	X	X	X	
	SBD: awareness/knowledge of and opinion about the program		X		X
	SBD: Barriers (actual and perceived) to participating in the program	X	X		X
	SBD: program features and activities to increase participation, especially among high-priority markets	X	X	X	X
	Market: perceived barriers to increasing energy efficiency and how these vary across sectors	X	X	X	X
	Market: unique features of the [insert region] market	X			X
	Market: market distinctions and how they affect energy efficiency decisions		X		X
	Experience: Design/Build (contracting) agreements	X	X	X	
	Experience: building types, sizes, and complexities constructed	X	X	X	
Two	**Construction:** Relationships between ownership characteristics and building type		X		X
	Construction: differences in design and construction processes by building type and complexity		X		X
	Market: relationships between market characteristics and barriers to increased energy efficiency	X	X	X	X
	Construction: options for increasing energy efficiency in leased buildings, including providing incentives to tenants moving into the space	X	X	X	
	Market/Trends: energy efficiency characteristics and trends related to various contracting arrangements		X		X
	Trends: perceived influential market trends over the next five years	X	X	X	X

Tier	Research Questions	CA Program Managers/Staff	Program Participants	Non-CA Program Managers/Staff	Industry Experts
	Trends: commercial building construction trends over the next five years	X	X	X	X
	Trends: Expected split between new construction and major renovations in the next five years	X			
	Trends: Energy efficiency and construction trends and their anticipated effects	X		X	X
Three	**Trends:** likely long-term effects of the current economic downturn and expected economic and other trends on the market characteristics	X			
	Market/Trends: Adaptations by market actors to current market conditions	X	X	X	X
	Market: unique characteristics of the renovation market	X			

The data from the interviews was used to characterize the market and develop key findings. Because the sample size was relatively small, the findings from this market characterization are indicative of the nature of the market and trends, but are not statistically valid. However, there was sufficient agreement among the respondents on a number of topics. This generalized view of the market characterization gave the Navigant team perspective on the needs of the program.

1.3.3 Savings By Design Market & Economic Trends

The Navigant team undertook a comprehensive literature and secondary study search to provide information on the broader market and economic trends impacting the SBD program. Sources included industry publications and journals, construction industry forecasts, economic forecasts, government statistics and forecasts, and general press sources. This data informed both the qualitative and quantitative information gathered about the impacts of the 2007-2009 recession[13] on relevant commercial buildings markets, and in particular, about the levels and types of commercial building and development activities that are most likely to see increases over the next three to five years in relevant utility service areas. Additionally, Navigant's interviews with key market actors provided depth and insight to the literature and secondary studies.

1.3.4 Best Practice Interviews

Phase II focused on those market sectors that were determined as having the greatest Future Savings Potential for each IOU during the Phase I analysis. Interviews were conducted with managers of

[13] Start and end dates for recessions are set by the National Bureau of Economic Research. The 2007-2009 recession is defined here: http://www.nber.org/cycles/sept2010.html.

exemplary energy efficiency programs and targeted industry experts to explore the best approaches for meeting these key market sectors. Best practice programs were selected from a recent American Council for an Energy-Efficient Economy (ACEEE) paper[14] identifying best-of-breed programs, references from subject experts and the authors' awareness of leading programs. Additionally, after reviewing the building markets identified in the gap analysis, subject matter experts with detailed regional and national knowledge regarding high priority potential markets were identified. Navigant conducted a common interview approach for each NRNC program and a slightly modified interview approach to the subject matter expert to gather the needed information. Those interviewed are identified in Table 1-3 below.

Table 1-3: Organizations and Subject Matter Experts Interviewed in Best Practice Study

Organization	Subject Expert
Energy Trust of Oregon	Jessica Rose, Business Sector Manager for NC
Efficiency Vermont	Paul Duane, Planning and Development Manager
Fisher-Nickel	Don Fisher, Founding Partner
NEEA	John Jennings, Senior Product Manager
NYSERDA	Craig Kneeland, Project Manager

Navigant's team reviewed findings from the Market Characterization and developed a set of interview questions for these market experts which addressed the key issues of interest to SBD as well as building upon the findings from the *2011 SCE SBD Study*. Interview questions can be broadly categorized in the following three categories:

- ***Components of Successful NRNC Programs*** – Through analyzing the components of a NRNC Program such as marketing, implementation, quality control, etc., the findings of *2011 SCE SBD Study* were updated.
- ***Trends and Innovations of Best-of-Breed Programs*** –Navigant probed each subject expert regarding innovative approaches to NRNC that are overcoming the barriers to participation as well as the barriers to comprehensive savings within each participating building. Additionally, trends and pilot programs of Best-of-Breed programs were explored.
- ***Barriers and Solutions to SBD Priority Buildings*** – Referencing the building markets identified in the Program Market Penetration and Savings Potential analysis, subject matter experts were interviewed regarding specific solutions they have employed to meet the needs of these markets.

Navigant's exploration of best practices and options for reaching the priority market sectors went beyond just identifying the opportunities available by market. Navigant's approach also included an exploration of the three most prevalent project delivery methods (i.e., Design/Bid/Build [DBB], Design/Build with Design Team [DBwDT], and Design/Build with Contractors [DBwC]) to better understand how to reach potential customers. While each market segment does not align perfectly with

[14] Nowak, S. et al., "Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs", June 2013, Report Number U132

a specific project delivery method, the exploration of these delivery methods offered the Navigant team insights into other options for reaching potential partners and increasing program participation.

2. Building Design Processes

Non-residential buildings are designed and built in a variety of ways depending on the building complexity and design process chosen. As part of this study Navigant explored the effect of design process on the SBD program. While building design processes are as varied and unique as the buildings being designed and are influenced by the building's complexity, most design processes can broadly be characterized in a few high-level categories. Navigant has characterized these processes as: DBB, DBwDT, and DBwC. This section serves to define these design options, while subsequent sections describe Navigant's savings potential and SBD gap analysis assessment (i.e., between current participation and the economic potential for SBD savings in key sub-markets; as well as the effects on building design on SBD). These categories are essential to distinguish because the SBD approach can be markedly different between building design processes.

Table 2-1, below, provides an overview of these processes, the market actors associated with each, and the typical commercial building projects associated with the particular process.

Table 2-1: Typical Market Design/Delivery Methods for Commercial Building Construction

	Methods	Players	Components	Typical Project
1	**Design/Bid/Build (DBB)**	Owner, Architect and Engineers	Plans and Specifications	Formal projects, government, institutional work involving public dollars.
2	**Design/Build with Design Team (DBwDT)**	Owner, Architect and Developer or Construction Manager	Plans	Medium complexity buildings, developers, commercial projects.
3	**Design/Build with contractors (DBwC)**	Owner, General Contractor, and Sub-contractors	Rough plans	Smaller, less complex buildings, fit=ups, gut/rehabs, small businesses.

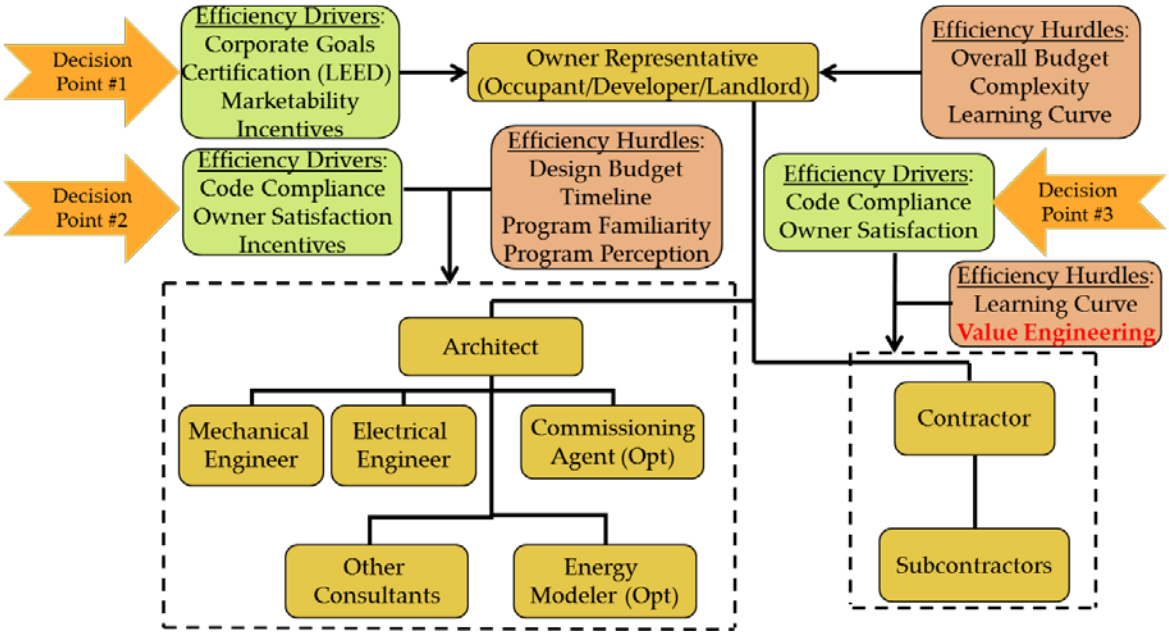
Source: Navigant Analysis

Based on Navigant's past experience, the differences between these three commercial building project delivery methods can provide key insights into market actor behaviors and needs that may enable SBD program designers and implementers to increase program participation. In this study, Navigant investigates the hypothesis that *Design/Build* projects (methods 2 and 3 in Table 2-1) are under-represented in their participation in SBD program.

2.1 Design/Bid/Build

The DBB process is characterized primarily by separate design and construction teams. This process, being the most formal includes longer lead times as a bid design is finalized prior to General Contractor (GC) selection. This process is well-suited to large and complex buildings and may be required in certain types of public sector buildings. A typical leadership hierarchy is presented in Figure 2-1.

Figure 2-1: Decision Making Tree for DBB Process



Source: Navigant Analysis

Typical DBB Process:

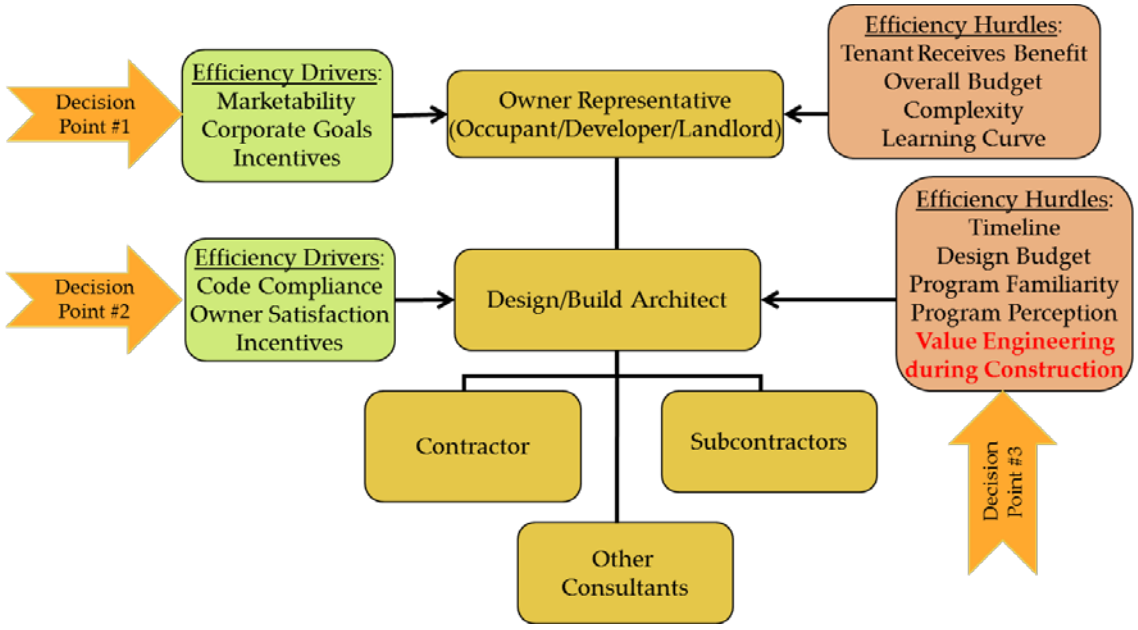
1. Owner identifies project and establishes program requirements.
2. Architect selection phase – RFP, pre-qualification, design competition.
3. Conceptual Design phase – Program, bubble diagrams, space adjacency.
4. Schematic Design phase – Sketches take form, site considerations.
5. Design Development phase – Owner reviews preliminary design and modifies.
   a. If Energy Modeling building – Use model outputs to optimize design.
   b. If Commissioning – Agent participates in design process.
6. Bid Documents phase – Finalized design prior to GC comments.
7. Project goes out to bid – Competitive selection of GC, may be construction cost driven.
8. Construction Documents phase – Finalized design with GC comments.
9. Construction phase – Change orders capture any subsequent changes.
10. Value Engineering phase – If project is budget, contractors are invited to find cuts.
11. Construction complete – Final stages are inspections and issuing a certificate of occupancy.

DBB design process works well with a program like SBD. There is a relatively long design phase where there are multiple opportunities for the efficiency program to review design documents as they develop. The program can sit down for face-to-fact meetings, provide written or verbal feedback and suggestions, and negotiate efficiency enhancements. Additionally, there is time to develop building energy simulation models and discuss energy opportunities.

2.2 *Design/Build with Design Teams*

The DBwDT process is characterized by the same firm doing the design and construction, thereby eliminating the time and cost of making separate bid and construction drawings and the time to select a GC. This process generally has a tighter timeline than DBB, but still maintains a design process before construction. Due to the tighter timeline there is less opportunity for design reviews, especially with an energy efficiency program. DBwDT is well suited for medium complexity buildings on a tight timeline or budget. A typical leadership hierarchy is presented in Figure 2-2.

Figure 2-2: Decision Making Tree for DBwDT Process



Source: Navigant Analysis

Typical Steps in the DBwDT Process:

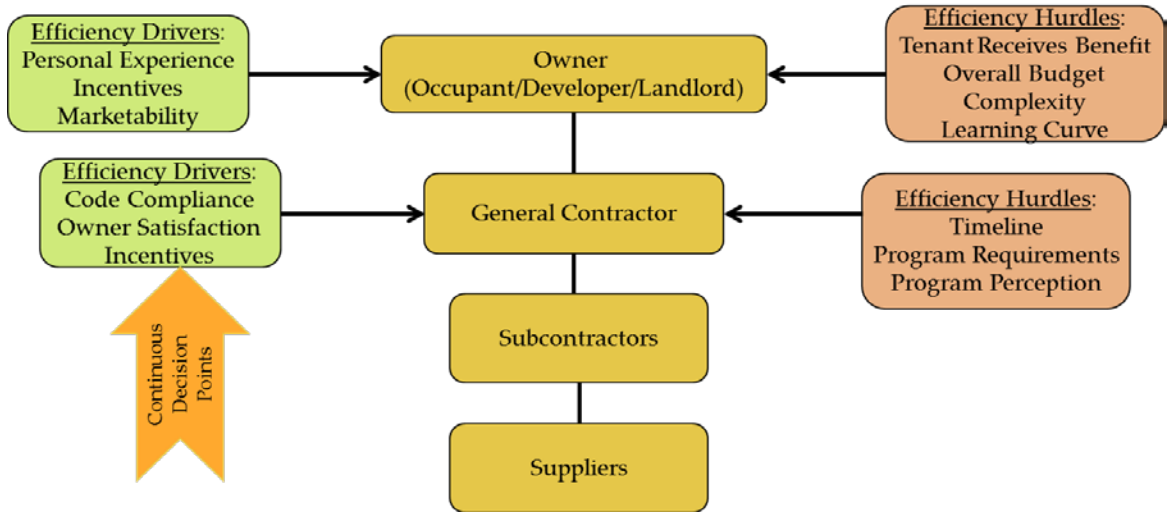
1. Owner hires an architectural design-build firm, construction services manager, developer, or owner may be a developer.
2. Owner specifies what the end product should be (size, rooms, function).
3. Architectural Design/Build firm draws up plans, hires and manages contractors as well as other consultants, which usually includes some fee-for-service engineering.
4. Mechanical and electrical contractors do the bulk of design for their respective systems, possibly with approval of fee-for-service engineer, or engineer on Design/Build firm staff.
5. Building system components get built by each subcontractor.

This building design process can work well with the current SBD program if the Design/Build firm is familiar with the SBD program and knows which design features will benefit from energy efficiency. However, DBwDT relies on the existing design team not needing technical assistance in energy efficient design. Less skilled design team members or Design/Build firms that require more direction may be disinclined to participate in the SBD program.

2.3 Design/Build with Contractor

The DBwC process is characterized by a General Contractor being responsible for both the design and the construction. The least formal of the design processes outlined here, DBwC can include separate design and construction phases or may be characterized by design and construction occurring in tandem. DBwC is typically chosen for smaller buildings, gut/rehabs or additions to existing buildings. While the scope of these building is limited, the typically high volumes can represent a significant portion of the NRNC building market in aggregate. A typical leadership hierarchy is presented in Figure 2-3.

Figure 2-3: Decision Making Tree for DBwC Process



Source: Navigant Analysis

Typical Steps in the DBwC Process:

1. Owner hires a general contractor.
2. Owner specifies their needs for the end product (size, rooms, function).
3. General Contractor solicits pricing from one or more subcontractor.
4. General Contractor typically drafts a rough layout and provides a written scope of work for what's included in price.
5. General contractor will hire mechanical and electrical contractors to "design" and build those systems.

These smaller buildings are typically the most challenging for a NRNC program to influence. Challenges include a high volume of projects each with relatively small savings potential, extremely short design lead times with design decisions happening at multiple points during the construction, tight project budgets with little allocated to design, and industry conventions difficult to change. Additionally for budgetary reasons material vendor/supply houses may provide the layout, which can lead to "rule of thumb" sizing instead of designs based on mechanical load or luminance needed.

In the study below, Navigant explores the relationship of these non-residential building Design/Build methodologies to the SBD program as currently designed, with a goal of identifying priority markets and focuses to both enhance existing program efforts as well as increase participation in "harder-to-reach" commercial markets.

3. Program Market Penetration and Savings Potential

In this chapter we describe the results of our analysis of historic market penetration and future savings potential for the SBD program. Historic market penetration and savings potential were determined for each of the California IOUs separately, with a main focus of determining the two market sectors with the highest potential savings potential for each IOU. The results of the analysis are presented below in sections specific to each IOU. Additionally, we identify building types by design process with a focus on identifying building types that fall into SBD program "sweet spots" and those that present greater challenges for encouraging enhanced participation in the program.

3.1 Design Process by Building Type

In *Section 2 – Building Design Processes*, Navigant defined three typical design processes: DBB, DBwDT, and DBwC. While each building is unique, certain building design processes tend to dominate certain commercial building types. Table 3-1 presents the prevalence of each design type within each building type. Additional discussion on how these design process relate to remaining potential for SBD are included in observations of the results for each IOU in the following sections.

Table 3-1: Design Process by Building Type (by percent of building area)

Building Type	Design/Bid/ Build	Design/Build	Design/Build with Contractors
Amusement, Social and Recreational Bldgs.	15%	50%	35%
Dormitories	50%	35%	15%
Government Service Buildings	60%	30%	10%
Hospitals and Other Health Treatment	60%	25%	15%
Hotels and Motels	15%	50%	35%
Manufacturing Plants, Warehouses, Labs	20%	60%	20%
Miscellaneous Nonresidential Buildings	35%	40%	25%
Office and Bank Buildings	60%	30%	10%
Parking Garages and Automotive Services	5%	30%	65%
Religious Buildings	50%	35%	15%
Schools, Libraries, and Labs (nonmfg)	60%	30%	10%
Stores and Restaurants	15%	50%	35%
Warehouses (excl. manufacturer owned)	2%	33%	65%

Source: Navigant Team Expert Opinion

3.2 PG&E Results

This section presents a summary of the results for PG&E. Full results along with a detailed discussion of data gaps and methodology adjustments can be found in *PG&E Detailed Program Market Potential Results*. Additionally, all limitations of the following analysis are documented in *Section 3.5-Analysis Limitations.*

3.2.1 Historic Program Market Penetration and Savings

Within PG&E's service territory five building types account for 85 percent of the historic electric savings (MWh) and 72 percent of the historic demand savings (MW): *Hospitals and Other Health Treatment*; *Manufacturing Plants, Warehouses, Labs*; *Miscellaneous Nonresidential Buildings*; *Office and Bank Buildings*; and *Stores and Restaurants*. Five building types account for 88 percent of the historic gas savings: *Hospitals and Other Health Treatment*; *Manufacturing Plants, Warehouses, Labs*; *Office and Bank Buildings*; *Schools, Libraries, and Labs (nonmfg)*; and *Stores and Restaurants*.

PG&E customer participation in SBD generally increased from 2006 to 2009 and decreased in the following years. The overall participation rate in SBD for PG&E is documented by year in Table 3-2.

Table 3-2: PG&E Savings By Design Participation Rate by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
Participation Rate	11%	15%	13%	34%	15%	6%	3%

Source: Navigant Analysis

PG&E's SBD program market penetration varies significantly by building type as indicated in Table 3-3. Historically the highest participation rates, by building type, were achieved in *Manufacturing Plants, Warehouses, Labs* (83 percent), *Government Service Buildings* (37 percent) and *Miscellaneous Nonresidential Buildings* (36 percent) while the lowest participation rates were observed in *Parking Garages and Automotive Services* (0 percent), *Amusement, Social and Recreational Bldgs.* (1 percent), and *Dormitories* (0 percent). The calculation of average savings per square foot for each building type can be found in Table 3-3. This calculated value is used to forecast SBD Future Savings Potential ("Participant Savings" in Figure 1-1).

Table 3-3: PG&E Savings By Design Historical Average Participation Rate and Savings, 2006-2012

Building Type	Average Participation Rate	Savings kWh/Sqft	Savings kW/Sqft	Savings Therms/sqft
Amusement, Social and Recreational Bldgs.	1%	0.97	0.00073	0.0147
Dormitories	0%	0.00	0.00000	0.0000
Government Service Buildings	37%	1.51	0.00070	0.0469
Hospitals and Other Health Treatment	15%	5.29	0.00111	0.2527
Hotels and Motels	1%	0.42	0.00018	0.1592
Manufacturing Plants, Warehouses, Labs	83%	6.29	0.00103	0.1380
Miscellaneous Nonresidential Buildings	36%	10.19	0.00158	0.0202
Office and Bank Buildings	7%	5.36	0.00077	0.1253
Parking Garages and Automotive Services	0%[15]	0.89	0.00050	0.0000
Religious Buildings	3%	2.45	0.00164	0.1450
Schools, Libraries, and Labs (nonmfg)	14%	2.15	0.00119	0.0242
Stores and Restaurants	15%	3.92	0.00093	0.0092
Warehouses (excl. manufacturer owned)	14%	2.74	0.00056	0.0183

Source: Navigant Analysis

3.2.2 Savings By Design Future Program Savings Potential

A detailed future savings potential by building type for PG&E is reported in *Appendix F – PG&E Detailed Program Market Potential Result* and a discussion of the methodology for calculating future savings potential can be found in *Section 1.3.1 Future Savings Potential*. In summarizing the future potential (2013-2015) the following is worth acknowledging:

- The greatest electric savings (kWh) potential is in *Office and Bank Buildings* and *Stores and Restaurants*
- The greatest demand savings (kW) potential is in *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)*
- The greatest gas savings (therms) potential is in *Office and Bank Buildings* and *Hospitals and Other Health Treatment*.

Navigant combined the future savings potential into a single metric which PG&E can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric, demand, and gas savings respectively for each building type. Next, these percent values were averaged to come up with a composite value. Finally, buildings were ranked from high to low based on the composite values. The results are shown in Table 3-4. Based on the composite metric, *Office and Bank Buildings* and *Stores and Restaurants* are the two building types with the greatest future savings potential; *Hospitals and Other Health Treatment* rank third.

[15] The historic participation rate was 0.07%, which rounds down as presented in the table, but still provides some data on which to project future potential participation.

Table 3-4: PG&E Savings By Design Future Potential, Building Types by Rank

		2013-15 Remaining Potential			2013-15 Score (Percent of total future potential savings)			
Rank	*Building Type*	*MWh*	*MW*	*MTherm*	*MWh*	*MW*	*MTherm*	*Average Percent*
1	Office and Bank Buildings	254,857	37	5,959	32%	18%	41%	30%
2	Stores and Restaurants	194,689	46	456	24%	23%	3%	17%
3	Hospitals and Other Health Treatment	74,361	16	3,550	9%	8%	24%	14%
4	Schools, Libraries, and Labs (nonmfg)	71,673	40	806	9%	20%	5%	11%
5	Warehouses (excl. manufacturer owned)	64,889	13	435	8%	7%	3%	6%
6	Hotels and Motels	5,905	3	2,246	1%	1%	15%	6%
7	Miscellaneous Nonresidential Buildings	62,656	10	124	8%	5%	1%	5%
8	Parking Garages and Automotive Services	33,345	19	0	4%	9%	0%	4%
9	Government Service Buildings	10,593	5	328	1%	2%	2%	2%
10	Religious Buildings	6,782	5	402	1%	2%	3%	2%
11	Manufacturing Plants, Warehouses, Labs	12,893	2	283	2%	1%	2%	2%
12	Amusement, Social and Recreational Bldgs.	7,128	5	108	1%	3%	1%	1%
13	Dormitories	0	0	0	0%	0%	0%	0%

Source: Navigant Analysis

Appendix F – PG&E Detailed Program Market Potential Results breaks down the results still further, indicating future savings potential for each of the top four building types, by rank, within each county of the PG&E service territory.

3.2.3 Additional Observations

Within the PG&E territory, customer participation rate in SBD as well as total program electric savings generally increased from 2006 to 2009 with some minor fluctuations. Participation and program electric savings decreased dramatically in the following years from 2010 to 2012. This seems to correspond with the decrease in new construction activity due to the onset of the recession. From 2006 through 2010 program gas savings generally increased, but saw a substantial drop from 2010 through 2012.

The ratio of the historical average annual program savings to average annual future potential indicates the relative growth potential amongst each building type. This ratio is presented in Table 3-5.

Overall, program electric savings (MWh) has the potential to add another four times the current program savings. SBD historically had a strong uptake in certain building types; if expected participation rates continue in these building types there is limited ability to increase savings (the most extreme case being *Manufacturing Plants, Warehouses, and Labs*). Large growth in savings can occur in certain building types that have seen limited historical participation (such as *Parking Garages and Automotive Services* and *Hotels and Motels*). A large portion of future potential lies in building types that are already generating significant savings for SBD (such as *Stores and Restaurants*, *Hospitals and Other Health Treatment* and *Office and Bank Buildings*).

Overall, program gas savings (MTherms) has the potential to add another 1.4 times the current program savings. While *Stores and Restaurants* show a large potential for new electric savings, there is limited potential to increase gas savings. However, *Office and Bank Buildings* and *Hospitals and Other Health Treatment* present an opportunity to simultaneously increase both electric and gas savings, as illustrated in Table 3-4.

Table 3-6 relates the historical savings and future potential respectively to the typical distribution of design processes by building type. The table reports a weighted average distribution, weighted in MWh savings, of design types for both historical savings and future potential. Historically, program participants were most likely to follow a DBwDT process (46%). DBB (30%) and DBwC (24%) were less common. The distribution of future potential varies with the DBB process accounting for largest portion of future potential (39%). To achieve greater savings in the future, PG&E may need to place greater priority on assisting customers that follow a DBB process. The building types that tend to follow these processes and have large future potential include *Office and Bank Buildings, Hospitals and Other Health Treatment* and *Schools, Libraries, and Labs (nonmfg)*. Other building types with significant future potential are *Stores and Restaurants* which tend to use a DBwDT process and *Warehouses (excl. manufacturer owned)* which largely follow a DBwC process.

Table 3-5: PG&E Savings By Design Historical Savings vs. Future Potential

Building Type	Historical Participation Rate	Average Annual Historical Savings, 2006-2012 (MWh)	Average Annual Future Potential, 2013-2015 (MWh)	Electric Potential/ Historical Savings (ratio)	Average Annual Historical Savings, 2006-2012 (MTherms)	Average Annual Future Potential, 2013-2015 (MTherms)	Gas Potential/ Historical Savings (ratio)
Amusement, Social and Recreational Bldgs.	1%	35	2,465	*69.9*	5	38	*8.0*
Dormitories	0%	0	0	*0*	0	0	*0*
Government Service Buildings	37%	1,353	3,487	*2.6*	239	108	*0.5*
Hospitals and Other Health Treatment	15%	5,550	24,582	*4.4*	1,581	1,174	*0.7*
Hotels and Motels	1%	25.3	1,976	*78.1*	55.0	752	*13.7*
Manufacturing Plants, Warehouses, Labs	83%	21,925	4,368	*0.2*	477	96	*0.2*
Miscellaneous Nonresidential Buildings	36%	8,682	20,834	*2.4*	92	41	*0.4*
Office and Bank Buildings	7%	5,387	86,021	*16.0*	307	2,012	*6.6*
Parking Garages and Automotive Services	0%	8.3	11,319	*1,366*	0.0	0.0	*0*
Religious Buildings	3%	84.0	2,219	*26.4*	34.9	131	*3.8*
Schools, Libraries, and Labs (nonmfg)	14%	5,201	24,340	*4.7*	303	274	*0.9*
Stores and Restaurants	15%	15,640	65,885	*4.2*	404	154	*0.4*
Warehouses (excl. manufacturer owned)	14%	3,216	22,335	*6.9*	-16[16]	149	*-9.2*
Total	**14%**	**67,107**	**269,830**	***4.0***	**3,483**	**4,928**	***1.4***

Source: Navigant Analysis

[16] Negative gas savings are possible through efficiency solutions that favor electric savings over gas and ultimately increase gas usage through interactive effects. With negative historic gas savings and positive future potential savings, the ratio of gas potential future savings to historic savings will also present as negative.

Table 3-6: PG&E Savings By Design Electric Savings by Building Type and Design Process

Building Type	Average Annual Historical Program Savings, 2006-2012 (MWh)	Design/ Bid Build	Design/ Build	Design/ Build with Contractors	Average Annual Future Potential, 2013-2015 (MWh)	Design/ Bid Build	Design / Build	Design/ Build with Contractors
Amusement, Social and Recreational Bldgs.	35	15%	50%	35%	2,465	15%	50%	35%
Dormitories	0	50%	35%	15%	0	50%	35%	15%
Government Service Buildings	1,353	60%	30%	10%	3,487	60%	30%	10%
Hospitals and Other Health Treatment	5,550	60%	25%	15%	24,582	60%	25%	15%
Hotels and Motels	25	15%	50%	35%	1,976	15%	50%	35%
Manufacturing Plants, Warehouses, Labs	21,925	20%	60%	20%	4,368	20%	60%	20%
Miscellaneous Nonresidential Buildings	8,682	35%	40%	25%	20,834	35%	40%	25%
Office and Bank Buildings	5,387	60%	30%	10%	86,021	60%	30%	10%
Parking Garages and Automotive Services	8	5%	30%	65%	11,319	5%	30%	65%
Religious Buildings	84	50%	35%	15%	2,219	50%	35%	15%
Schools, Libraries, and Labs (nonmfg)	5,201	60%	30%	10%	24,340	60%	30%	10%
Stores and Restaurants	15,640	15%	50%	35%	65,885	15%	50%	35%
Warehouses (excl. manufacturer owned)	3,216	2%	33%	65%	22,335	2%	33%	65%
Savings Weighted Average	**N/A**	**30%**	**46%**[17]	**24%**	**N/A**	**39%**	**36%**	**25%**

Source: Navigant Analysis

[17] While it was noted that the SBD program appears to be designed around a Design Bid Build process, these data suggest that projects in PG&E territory have Design/Build firms capable of participating in the program within the constraints of the Design/Build framework. It is suggested that this observation is further studied by tracking the design process of future SBD projects.

3.3 SDG&E Results

This section presents a summary of the results for SDG&E. Detailed discussion on data gaps, methodology adjustments, and full results can be found in *SDG&E Detailed Program Market Potential Results*. Additionally, all limitations of the following analysis are documented in *Section 3.5-Analysis Limitations.*

3.3.1 Historic Program Market Penetration and Savings

Within SDG&E's service territory five building types account for 77 percent of the historic electric savings (MWh) and 85 percent of the historic demand savings (MW): *Manufacturing Plants, Warehouses, Labs*; *Office and Bank Buildings*; *Parking Garages and Automotive Services*; Schools, *Libraries, and Labs (nonmfg)*; and *Stores and Restaurants*. Five building types account for 96 percent of the historic gas savings: *Dormitories*; *Manufacturing Plants, Warehouses, Labs*; *Miscellaneous Nonresidential Buildings*; *Schools, Libraries, and Labs (nonmfg)*; and *Warehouses (excl. manufacturer owned)*.

SDG&E participation in SBD increased from 2006 to 2008, as documented in Table 3-7. Participation does not seem to follow a trend from 2009 to 2012.

Table 3-7: SDG&E Savings By Design Participation Rate by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
Participation Rate	6%	16%	16%	12%	26%	5%	41%

Source: Navigant Analysis

SDG&E's SBD program market penetration varies significantly by building type as indicated in Table 3-8. Historically the highest participation rates, by building type, were achieved in *Dormitories* (65 percent) and *Parking Garages* (45 percent) while the lowest participation rates were observed in *Hotels and Motels* (1 percent) and *Warehouses* (3 percent). The calculation of average savings per square foot for each building type is found in Table 3-8. This calculated value is used to forecast SBD Future Savings Potential ("Participant Savings" in Figure 1-1).

Table 3-8: SDG&E Savings By Design Historical Average Participation Rate and Savings, 2006-2012

Building Type	Average Participation Rate	Savings kWh/Sqft	Savings kW/Sqft	Savings Therms/sqft
Amusement, Social and Recreational Bldgs.	10%	3.17	0.00122	0.1197
Dormitories	65%	1.91	0.00031	0.0357
Government Service Buildings	12%	2.68	0.00060	0.0420
Hospitals and Other Health Treatment	12%	5.43	0.00101	0.0027
Hotels and Motels	1%	0.41	0.00007	0.0065
Manufacturing Plants, Warehouses, Labs	19%	6.83	0.00156	0.1597
Miscellaneous Nonresidential Buildings	31%	2.64	-0.00007	0.0386
Office and Bank Buildings	16%	1.62	0.00063	0.0006
Parking Garages and Automotive Services	40%	1.32	0.00020	0.0001
Religious Buildings	6%	3.08	0.00146	0.0094
Schools, Libraries, and Labs (nonmfg)	17%	2.92	0.00155	0.0284
Stores and Restaurants	6%	5.34	0.00128	-0.0064
Warehouses (excl. manufacturer owned)	3%	9.96	0.00178	0.0014

Source: Navigant Analysis

3.3.2 Savings By Design Future Program Savings Potential

A detailed future savings potential by building type for SDG&E's is reported in *SDG&E Detailed Program Market Potential Results* and a discussion of the methodology for calculating future savings potential can be found in *Section 1.3.1 Future Savings Potential*. In summarizing the future potential (2013-2015) the following is worth acknowledging:

- The greatest electric savings (MWh) potential is in *Stores and Restaurants* and *Warehouses (excl. manufacturer owned)*
- The greatest demand savings (MW) potential is in *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)*
- The greatest gas savings (Therms) potential is in *Manufacturing Plants, Warehouses, Labs* and *Miscellaneous Nonresidential Buildings*

Navigant combined the future potential into single metric which SDG&E can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric, demand, and gas savings respectively for each building type. Next, these percent values were averaged to come up with a composite value. Finally, buildings were ranked from high to low based on the composite values. The results are shown in Table 3-9. Based on the composite metric, *Manufacturing Plants, Warehouses, Labs* and *Schools, Libraries, and Labs (nonmfg)* are the two building types with the greatest future savings potential; *Stores and Restaurants* rank third.

Table 3-9: SDG&E Savings By Design Future Potential, Building Types by Rank

		2013-15 Future Potential			2013-15 Score (Percent of total future potential savings)			
Rank	*Building Type*	*MWh*	*MW*	*MTherm*	*MWh*	*MW*	*MTherm*	*Average Percent*
1	Manufacturing Plants, Warehouses, Labs	23,317	5	545	9%	7%	51%	**23%**
2	Schools, Libraries, and Labs (nonmfg)	28,943	15	281	11%	21%	27%	**20%**
3	Stores and Restaurants	92,493	22	-110[18]	35%	31%	-10%	**18%**
4	Warehouses (excl. manufacturer owned)	46,856	8	6	18%	12%	1%	**10%**
5	Office and Bank Buildings	27,142	11	9	10%	15%	1%	**9%**
6	Amusement, Social and Recreational Bldgs.	3,440	1	130	1%	2%	12%	**5%**
7	Hospitals and Other Health Treatment	21,853	4	11	8%	6%	1%	**5%**
8	Government Service Buildings	4,177	1	66	2%	1%	6%	**3%**
9	Parking Garages and Automotive Services	10,123	2	1	4%	2%	0%	**2%**
10	Dormitories	2,442	0	46	1%	1%	4%	**2%**
11	Hotels and Motels	2,413	0	38	1%	1%	4%	**2%**
12	Miscellaneous Nonresidential Buildings	2,112	0	31	1%	0%	3%	**1%**
13	Religious Buildings	2,272	1	7	1%	2%	1%	**1%**

Source: Navigant Analysis

Appendix G – SDG&E Detailed Program Market Potential Results breaks down the results still further, indicating future savings potential for each of the top four building types, by rank, within each county of the SDG&E service territory.

3.3.3 Additional Observations

Within the SDG&E territory, customer participation rate in SBD as well as total program electric savings increased from 2006 to 2008. Participation and program electric savings remained relatively high in 2009 and 2010 but fluctuated relative to previous years. This seems somewhat surprising as the commercial new construction market slowed rapidly starting in late 2008 and early 2009 at the onset of the recession. The participation levels and savings levels in 2009 and 2010 may be due to two factors: 1) construction projects that started prior to the recession and were completed in 2009 or 2010, or 2) activity for existing

[18] Negative gas savings are possible through efficiency solutions that favor electric savings over gas and ultimately increase gas usage through interactive effects.

building renovation projects increased making up for any gap in new construction activity. Participation rate and total program savings decreased dramatically in 2011 but increased dramatically in 2012. Total program gas savings do not seem to follow a trend from 2006 through 2012. From 2007 through 2009 gas savings were relatively low (sometimes negative) but increased from 2010 through 2012.

The ratio of the historical average annual program savings to average annual future potential indicates the relative growth potential amongst each building type. This ratio is presented in Table 3-10.

Overall, program electric savings (MWh) has the potential to add another 1.6 times the current program savings. SBD historically had a strong uptake in certain building types; if expected participation rates continue in these building types there is limited ability to increase savings (in buildings such as *Parking Garages and Automotive Services* and *Dormitories*). Large growth in savings can occurring in certain building types that have seen limited past participation (such as *Warehouses*); however, the majority of future potential lies in building types that are already generating significant savings for SBD (such as *Stores and Restaurants* and *Office and Bank Buildings*).

Overall, program gas savings (MTherms) has the potential to add another two times the current program savings. While *Warehouses* show a large potential for new electric savings, there is limited potential to increase gas savings. Increasing program participation for *Stores and Restaurants* would increase program electric savings but are forecasted to decrease program gas savings, as illustrated in Table 3-9.

Table 3-11 relates the historical savings and future potential respectively to the typical distribution of design processes used by each building type. The table reports a weighted average distribution, weighted on MWh savings, of design types for both historical savings and future potential. Historically, program participants were more likely to follow a DBwDT process (38 percent). DBB (30 percent) and DBwC (29 percent) were slightly less common. The distribution of future potential is relatively similar with the DBwDT process accounting for largest portion of remaining potential (40 percent). To achieve greater savings in the future, SDG&E should continue to place priority on assisting customers that tend to follow a DBwDT process. The building types that tend to follow the DBB process and have large future potential include *Stores and Restaurants* and *Manufacturing Plants, Warehouses, Labs*. Other building types with significant future potential are *Office and Bank Buildings; Hospitals and Other Health Treatment;* and *Schools, Libraries, and Labs (nonmfg*) which tend to follow a DBB process as well as *Warehouses (excl. manufacturer owned)* which largely follow a DBwC process.

Table 3-10: SDG&E Savings By Design Historical Savings vs. Future Potential

Building Type	Historical Participation Rate	Average Annual Historical Savings, 2006-2012– (MWh)	Average Annual Future Potential, 2013-2015–(MWh)	Electric Future/ Historical Savings (ratio)	Average Annual Historical Savings, 2006-2012 (MTherms)	Average Annual Future Potential, 2013-2015 (MTherms)	Gas Future/ Historical Savings (ratio)
Amusement, Social and Recreational Bldgs.	10%	176	1,233	7.0	7	46	7.0
Dormitories	65%	860	841	1.0	16	16	1.0
Government Service Buildings	12%	193	1,532	7.9	3	24	7.9
Hospitals and Other Health Treatment	12%	1,031	7,567	7.3	1	4	7.6
Hotels and Motels	1%	10	818	83.0	0.2	13	82.7
Manufacturing Plants, Warehouses, Labs	19%	2,097	7,816	3.7	49	183	3.7
Miscellaneous Nonresidential Buildings	31%	230	694	3.0	37	113	3.0
Office and Bank Buildings	16%	1,792	9,180	5.1	1	3	4.9
Parking Garages and Automotive Services	40%	2,436	3,476	1.4	0.2	0.0	0.0
Religious Buildings	6%	58	725	12.6	0.2	2	13.6
Schools, Libraries, and Labs (nonmfg)	17%	2,151	9,885	4.6	21	96	4.6
Stores and Restaurants	6%	2,040	31,247	15.3	-2	-37	15.4*
Warehouses (excl. manufacturer owned)	3%	525	16,312	31.0	101	2	0.0
Total	**17%**	**57,894**	**91,326**	**1.6**	**233**	**465**	**2.0**

Source: Navigant Analysis

Table 3-11: SDG&E Savings By Design Electric Savings by Building Type and Design Process

Building Type	Average Annual Historical Program Savings, 2006-2012–(MWh)	Design/ Bid Build	Design/ Build	Design/ Build with Contractors	Average Annual Future Potential, 2013-2015–(MWh)	Design/ Bid Build	Design/ Build	Design/ Build with Contractors
Amusement, Social and Recreational Bldgs.	176	15%	50%	35%	1,233	15%	50%	35%
Dormitories	860	50%	35%	15%	841	50%	35%	15%
Government Service Buildings	193	60%	30%	10%	1,532	60%	30%	10%
Hospitals and Other Health Treatment	1,031	60%	25%	15%	7,567	60%	25%	15%
Hotels and Motels	10	15%	50%	35%	818	15%	50%	35%
Manufacturing Plants, Warehouses, Labs	2,097	20%	60%	20%	7,816	20%	60%	20%
Miscellaneous Nonresidential Buildings	230	35%	40%	25%	694	35%	40%	25%
Office and Bank Buildings	1,792	60%	30%	10%	9,180	60%	30%	10%
Parking Garages and Automotive Services	2,436	5%	30%	65%	3,476	5%	30%	65%
Religious Buildings	58	50%	35%	15%	725	50%	35%	15%
Schools, Libraries, and Labs (nonmfg)	2,151	60%	30%	10%	9,885	60%	30%	10%
Stores and Restaurants	2,040	15%	50%	35%	31,247	15%	50%	35%
Warehouses (excl. manufacturer owned)	525	2%	33%	65%	16,312	2%	33%	65%
Savings Weighted Average	**N/A**	**33%**	**38%**[19]	**29%**	**N/A**	**27%**	**40%**	**33%**

Source: Navigant Analysis

[19] While it was noted that the SBD program appears to be designed around a Design Bid Build process, these data suggest that projects in SDG&E territory have Design/Build firms capable of participating in the program within the constraints of the Design/Build framework. It is suggested that this observation is further studied by tracking the design process of future SBD projects.

3.4 SCE Results

This section presents a summary of the results for SCE. Full results along with a detailed discussion on data gaps and methodology adjustments can be found in *SCE Detailed Program Market Potential Results*. Additionally, all limitations of the following analysis are documented in *Section 3.5-Analysis Limitations.*

3.4.1 Historic Program Market Penetration and Savings

Within SCE's service territory five building types account for 86 percent of the historic electric savings (MWh) and 91 percent of the historic demand savings (MW): *Manufacturing Plants, Warehouses, Labs*; *Office and Bank Buildings*; *Schools, Libraries, and Labs (nonmfg)*; *Stores and Restaurants*; and *Warehouses (excl. manufacturer owned)*.

SCE customer participation in SBD generally remained flat with minor changes from 2006 to 2010, as indicated in Table 3-12. The participation rate decreased in the following years.

Table 3-12: SCE Savings By Design Participation Rate by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
Participation Rate	14%	12%	14%	15%	16%	12%	9%

Source: Navigant Analysis

SCE's SBD program market penetration varies significantly by building type as indicated in Table 3-13. Historically the highest participation rates, by building type, were achieved in *Manufacturing Plants, Warehouses, Labs* (37 percent), *Miscellaneous Nonresidential Buildings* (34 percent) and *Warehouses* (25 percent) while the lowest participation rates were observed in *Dormitories* (0 percent), *Parking Garages and Automotive Services* (0 percent) and *Religious Buildings* (0 percent). The calculated average savings per square foot for each building type can be found in Table 3-13. This calculated value is used to forecast SBD Future Savings Potential ("Participant Savings" in Figure 1-1).

Table 3-13: SCE Savings By Design Historical Average Participation Rate and Savings, 2006-2012

Building Type	Average Participation Rate	kWh/Sqft	kW/Sqft	Therms/sqft
Amusement, Social and Recreational Bldgs.	1%	0.90	0.00037	0
Dormitories	0%	0.00	0.00000	0
Government Service Buildings	1%	2.50	0.00138	0
Hospitals and Other Health Treatment	10%	2.29	0.00044	0
Hotels and Motels	7%	2.40	0.00033	0
Manufacturing Plants, Warehouses, Labs	37%	6.11	0.00082	0
Miscellaneous Nonresidential Buildings	34%	10.37	0.00113	0
Office and Bank Buildings	17%	3.25	0.00095	0
Parking Garages and Automotive Services	0%	0.85	0.00027	0
Religious Buildings	0%	0.00	0.00000	0
Schools, Libraries, and Labs (nonmfg)	12%	2.67	0.00117	0
Stores and Restaurants	12%	4.43	0.00091	0
Warehouses (excl. manufacturer owned)	25%	2.75	0.00040	0

Source: Navigant Analysis

3.4.2 Savings By Design Future Program Savings Potential

A detailed future savings potential by building type is reported in *SCE Detailed Program Market Potential Results* and a discussion of the methodology for calculating future savings potential can be found in *Section 1.3.1 Future Savings Potential*. In summarizing the future potential (2013-2015) the following is worth acknowledging:

- The greatest electric savings (kWh) potential is in *Stores and Restaurants* and *Warehouses (excl. manufacturer owned)*
- The greatest demand savings (kW) potential is in *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)*

Navigant combined the future savings potential into a single metric which SCE can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric and demand savings respectively for each building type. Next, these percent values were averaged to come up with a composite value. Finally, buildings were ranked from high to low based on the composite values. The results are shown in Table 3-14. Based on the composite metric, *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)* are the two building types with the greatest future savings potential.

Table 3-14: SCE Savings By Design Future Potential, Building Types by Rank

		2013-15 Remaining Potential			2013-15 Score (Percent of total future potential savings)			
Rank	*Building Type*	*MWh*	*MW*	*MTherm*	*MWh*	*MW*	*MTherm*	*Average Percent*
1	Stores and Restaurants	262,970	52	0	33%	29%	0%	31%
2	Schools, Libraries, and Labs (nonmfg)	103,648	32	0	13%	18%	0%	16%
3	Warehouses (excl. manufacturer owned)	117,966	18	0	15%	10%	0%	12%
4	Office and Bank Buildings	89,631	23	0	11%	13%	0%	12%
5	Hospitals and Other Health Treatment	65,414	16	0	8%	9%	0%	9%
6	Hotels and Motels	67,536	11	0	8%	6%	0%	7%
7	Parking Garages and Automotive Services	31,420	10	0	4%	6%	0%	5%
8	Manufacturing Plants, Warehouses, Labs	32,338	4	0	4%	2%	0%	3%
9	Government Service Buildings	12,489	7	0	2%	4%	0%	3%
10	Miscellaneous Nonresidential Buildings	16,472	2	0	2%	1%	0%	2%
11	Amusement, Social and Recreational Bldgs.	4,739	1	0	1%	1%	0%	1%
12	Dormitories	0	0	0	0%	0%	0%	0%
13	Religious Buildings	0	0	0	0%	0%	0%	0%

Source: Navigant Analysis

SCE Detailed Program Market Potential Results breaks down the results still further, indicating future savings potential for each of the top four building types, by rank, within each county of the SCE service territory.

3.4.3 Additional Observations

Navigant's method builds upon previous methods by estimating the potential in both new construction buildings and existing building renovations combined. By using both new construction and existing building renovations in the analysis, the overall participation rate is decreased from previous analysis. However, the analysis shows greater future potential than previous analysis because a larger population of eligible customers was considered.

Within the SCE territory, customer participation rate in SBD as well as total program savings remained generally consistent from 2006 to 2010, with some minor fluctuations. This seems somewhat surprising as the commercial new construction market slowed rapidly starting in late 2008 and early 2009 at the onset of the recession. The participation levels and savings levels in 2009 and 2010 may be due to two

factors: 1) construction projects that started prior to the recession and were completed in 2009 or 2010, or 2) activity for existing building renovation projects increased making up for any gap in new construction activity. Participation rate and total program savings decreased in the 2011 and 2012 program years.

The ratio of historical average annual program savings to average annual future potential indicates the relative growth potential amongst each building type. This ratio is presented in Table 3-15.

Overall, program electric savings (MWh) has the potential to add another five times the current program savings. Large growth in savings can occur in certain building types that have seen limited part participation (such as *Amusement, Social and Recreational Bldgs.*); however, the majority of future potential lies in building types that are already generating significant savings for SBD (such as *Stores and Restaurants* and *Warehouses*).

Table 3-16 relates the historical savings and future potential respectively to the typical distribution of design processes by building type. The table reports a weighted average distribution, weighted on MWh savings, of design types for both historical savings and future potential. Historically, program participants were more likely to follow a DBwDT process (4 percent). DBwC (34 percent) and DBB (2 percent) were less common. The distribution of future potential is relatively similar with the DBwDT process accounting for largest portion of future potential (40 percent). To achieve greater savings in the future, SCE should continue to place priority on assisting customers that tend to follow a DBwDT process. The building types that tend to follow the DBB process and have large future potential include *Stores and Restaurants* and *Hotels and Motels*. Other building types with significant future potential are *Office and Bank Buildings; Hospitals and Other Health Treatment;* and *Schools, Libraries, and Labs (nonmfg*) which tend to follow a DBwDT Build process as well as *Warehouses (excl. manufacturer owned)* which largely follow a DBwC process.

Table 3-15: SCE Savings By Design Historical Savings vs. Future Potential

Building Type	Historical Participation Rate	Average Annual Historical Program Savings, 2006-2012 (MWh)	Average Annual Future Potential, 2013-2015 (MWh)	Electric Potential/ Historical Savings (ratio)
Amusement, Social and Recreational Bldgs.	1%	15	1,503	101
Dormitories	0%	0	0	N/A
Government Service Buildings	1%	31	4,270	140
Hospitals and Other Health Treatment	10%	2,287	22,264	10
Hotels and Motels	7%	1,641	22,428	14
Manufacturing Plants, Warehouses, Labs	37%	8,091	13,359	2
Miscellaneous Nonresidential Buildings	34%	3,900	6,831	2
Office and Bank Buildings	17%	7,180	29,417	4
Parking Garages and Automotive Services	0%	7	10,640	1,585
Religious Buildings	0%	0	0	N/A
Schools, Libraries, and Labs (nonmfg)	12%	5,470	33,302	6
Stores and Restaurants	12%	13,297	85,950	6
Warehouses (excl. manufacturer owned)	25%	15,976	43,561	3
Total	**13%**	**57,894**	**273,526**	**5**

Source: Navigant Analysis

Table 3-16: SCE Savings By Design Electric Savings by Building Type and Design Process

Building Type	Average Annual Historical Program Savings, 2006-2012– (MWh)	Design/ Bid Build	Design/ Build	Design/ Build with Contractors	Average Annual Future Potential, 2013-2015– (MWh)	Design/ Bid Build	Design/ Build	Design/ Build with Contractors
Amusement, Social and Recreational Bldgs.	15	15%	50%	35%	1,503	15%	50%	35%
Dormitories	0	50%	35%	15%	0	50%	35%	15%
Government Service Buildings	31	60%	30%	10%	4,270	60%	30%	10%
Hospitals and Other Health Treatment	2,287	60%	25%	15%	22,264	60%	25%	15%
Hotels and Motels	1,641	15%	50%	35%	22,428	15%	50%	35%
Manufacturing Plants, Warehouses, Labs	8,091	20%	60%	20%	13,359	20%	60%	20%
Miscellaneous Nonresidential Buildings	3,900	35%	40%	25%	6,831	35%	40%	25%
Office and Bank Buildings	7,180	60%	30%	10%	29,417	60%	30%	10%
Parking Garages and Automotive Services	7	5%	30%	65%	10,640	5%	30%	65%
Religious Buildings	0	50%	35%	15%	0	50%	35%	15%
Schools, Libraries, and Labs (nonmfg)	5,470	60%	30%	10%	33,302	60%	30%	10%
Stores and Restaurants	13,297	15%	50%	35%	85,950	15%	50%	35%
Warehouses (excl. manufacturer owned)	15,976	2%	33%	65%	43,561	2%	33%	65%
Savings Weighted Average	**N/A**	**25%**	**41%**[20]	**34%**	**N/A**	**28%**	**40%**	**32%**

Source: Navigant Analysis

[20] While it was noted that the SBD program appears to be designed around a Design Bid Build process, these data suggest that projects in SCE territory have Design/Build firms capable of participating in the program within the constraints of the Design/Build framework. It is suggested that this observation is further studied by tracking the design process of future SBD projects.

3.5 Analysis Limitations

McGraw Hill's Dodge data was used in the program market penetration analysis to estimate historic new construction completions, by building type. This data provided an estimate for the entire new construction market allowing, Navigant to determine what percent of total new construction project were enrolling in the SBD program. Because of the data source, our results are subject to several uncertainties:

- McGraw Hill's Dodge data accurately reflects historic permit applications for new construction projects; however converting to construction completions requires several additional data points and assumptions that can add uncertainty to the data. The assumptions used to convert the data are based on information from the U.S. Census and Navigant's experience in the construction market.
- Dodge data for this project was purchased last in 2012. Forecasts for future new construction activity are based on McGraw Hill's best estimates for future new construction activity at that time. Even if more recent data was used, there is always an inherent uncertainty in projections for future construction activity. Navigant could not identify any better data sources than the Dodge data. The California Energy Commission even uses Dodge data to forecast construction activity for use in statewide planning. Navigant's use of Dodge data is, therefore, consistent with other California energy industry best practices.
- There are inherent uncertainties in using historic energy savings by building type and market penetration rates as the basis for future estimates. However, the historic data represents the best information available and is the best indicator of future opportunities.
- Neither Dodge data nor utility tracking data provides information on design process used. Navigant applied typical distributions of design process within a building category that are listed in Table 3-1. However the SBD program may have attracted certain design types disproportionally.
- Additional assumptions and uncertainties are listed in Table 3-17, by IOU.

Table 3-17: Specific Analysis Limitations by IOU

PG&E	» Assumptions were necessary to fill data gaps in historical participation data. These assumptions apply to approximately 65 percent of historical participants (based on savings). Navigant assumed the characteristics of the participants for which full data was available (35%) were a representative average that can be used to estimate missing data from other participants. While this may not be entirely accurate in the real world, it is the best assumption Navigant can make given the available data. Collecting square footage and building type data for all program participants would allow this analysis to be more robust in its next update.
SDG&E	» No additional analysis limitations

SCE	» Data for approximately 19 percent of historical participants from 2006-2009 (based on savings) were missing. Navigant assumed the characteristics of the participants for which full data were available (81%) are a representative average that can be used to estimate missing data from other participants. While this may not be entirely accurate, it is the best assumption Navigant can make given the available data. » From the 2010-2012 data that were provided, Navigant was only able to make use of the energy savings data. There was no way to distinguish unique participants from the given data which meant that all square footage values (while sparely populated to begin with) needed to be estimated. Navigant assumed the characteristics of the 2006-2009 participants (for which robust data was available) were a representative average from which square footage for 2010- 2012 participants could be estimated. While this may not be entirely accurate, it was the best assumption Navigant can make available the given data.

4. Market and Economic Trends

This section summarizes findings regarding the impact of the economic downturn. For a more detailed discussion of national and utility service area trends, please see *Appendix C: Economic Analysis Details -- National and IOU Service Territory Trends*. Key findings of the economic analysis included:

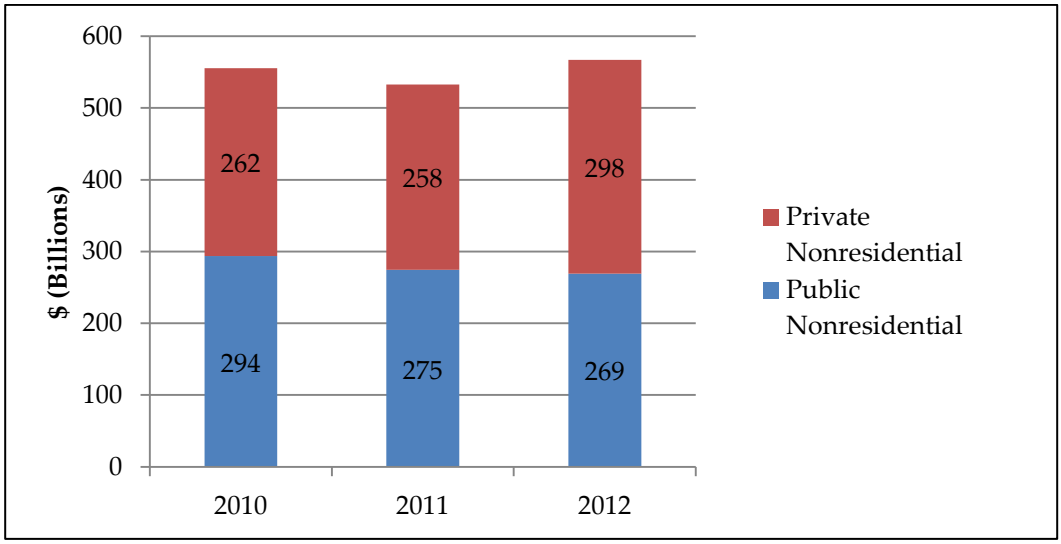
- The renovation sector continues to be a strong contributor to the California non-residential construction market. Current economic conditions have increased major renovations of existing facilities as an alternative to new construction – frequently repositioning them for different industry use (e.g., big box retail stores being renovated as healthcare facilities). SBD should ensure it is fully prepared to take advantage of opportunities in this area.
- Economic indicators suggest slow but steady growth for new non-residential buildings in each IOU service territory. Additionally, population data supports that finding.
- By considering the employment sectors with relatively robust growth, one can qualitatively infer which building sectors are likely to need new building stock. The *Professional and Business Services* sector is projected to have the largest growth across all of the three IOU service areas. Additionally, both new and re-purposed space is likely to be needed in the *Healthcare* sector and considerable growth is projected *in Leisure and Hospitality*.

4.1 Economic Indicators of the Building Market

The general consensus among industry experts and economists is that signs of market improvement have begun to emerge, albeit more slowly and fainter than most would prefer. Construction markets are expected to face a long and slow recovery. The available indicators support this assessment. As we now look to what the future might hold, we consider the following projections and predictions for the building market from key study sources and economic indicators.

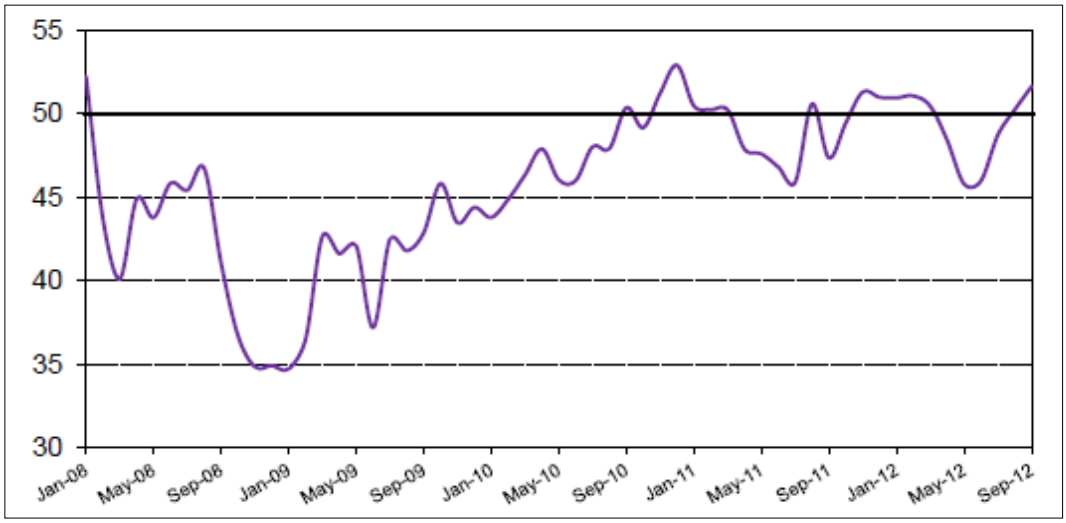
Nationally construction spending, while decreasing in the public sector, is slowing growing in the private sector as indicated in census data and Figure 4-1. The American Institute of Architects (AIA) indicates growth in both their Architectural Billings Index (ABI) and their Consensus Construction Forecast Panel. Figure 4-2 shows the ABI for 2008-2012. A number of 50 means no growth in architectural billing demand, while numbers larger than 50 represent growth. However, it should be noted that the West has lagged behind the rest of the country in ABI indicators.

Figure 4-1: U.S. Construction Spending, Nonresidential Public (v) Private, 2010 - 2012



Construction spending is total, not just spending on buildings. Not seasonally adjusted.
Source: U.S. Census Bureau http://www.census.gov/econ/currentdata/, Accessed 2/4/13

Figure 4-2: AIA Architectural Billings Index, 2008 - 2012

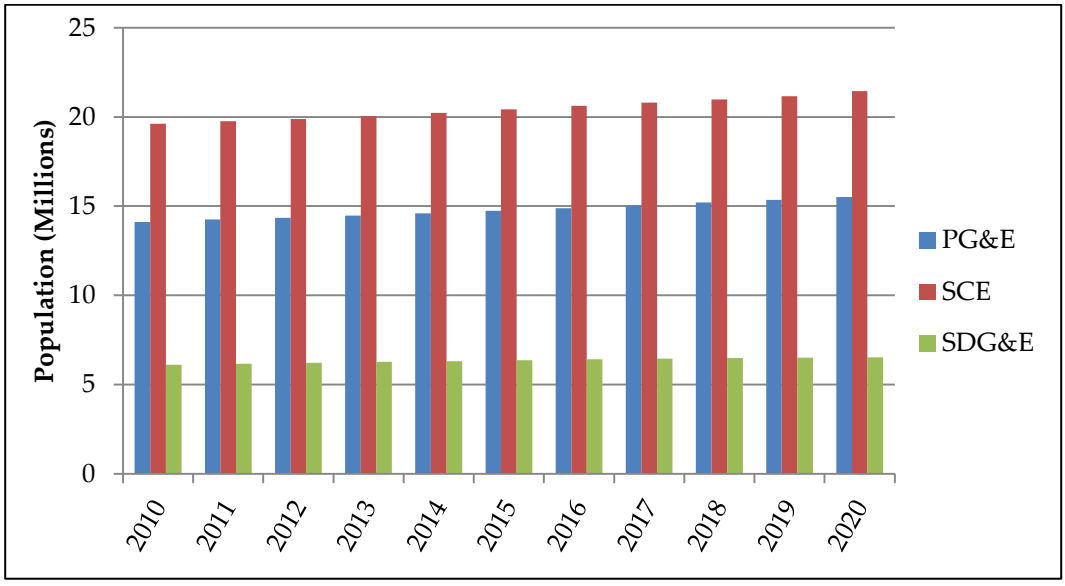


Source: AIA Architecture Billings Index as cited by Kermit Baker, Chief Economist, American Institute of Architects, in 2012 Economic Webcast: Post-Election Construction: Where Are We Heading? (Originally presented November 8, 2012).

4.2 Population Trends

For the purpose of this study, we considered population as a proxy for jobs and non-residential building demand. From April 2010 to July 2012 California's population grew 2.1 percent as compared to U.S. growth of 1.7 percent for the same period.[21] Looking forward to 2020, according to the State of California Department of Finance, California's population will grow to nearly 40.7 million, gaining more than 3.3 million people, an increase of 8.9 percent from the 2010 population (but still well short of pre-recession projections). The state anticipates significant population growth in coastal counties in Southern California, as well as in the Central Valley, parts of greater Sacramento and the Bay Area; however none of the largest percentage gains will be along the coast. Rural California counties will tend to have an increasingly aging population and tend to grow at a slower pace than the rest of the state.[22] Figure 4-3 shows the populations of the service areas of each PG&E, SCE and SDG&E by year from 2010 – 2020. While the largest population will remain in SCE's area (with a total projected population of almost 21.5 million by 2020), PG&E's area population will experience the largest percentage change, growing by 9.9 percent between 2010 and 2020. SDG&E's service area will experience 7 percent growth in the same decade.

Figure 4-3: Population by California IOU Service Area, 2010 – 2020



Sources: U.S. Census Bureau and State of California Department of Finance. Historical data end in 2010. Note that population figures are for entire counties included in each service area, even if multiple utilities serve a single county.

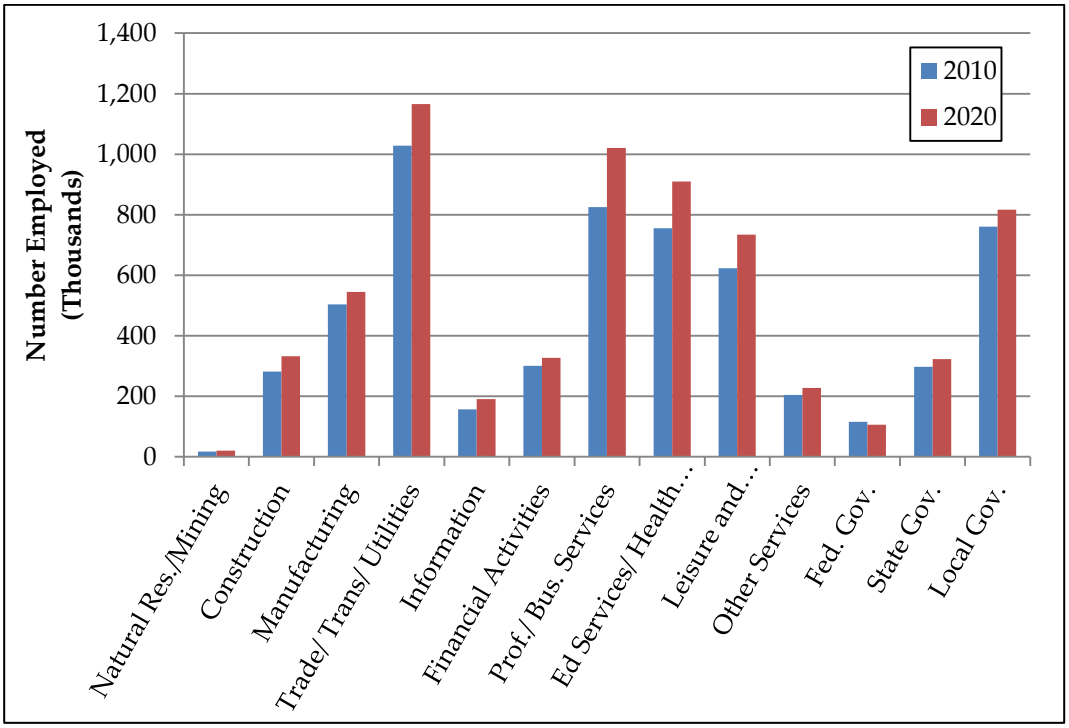
[21] http://quickfacts.census.gov/qfd/states/06000.html

[22] *State of California, Department of Finance, Report P-2: State and County Population Projections by Race/Ethnicity and 5-Year Age Groups, 2010-2060* (Sacramento, California: January 2013).
http://www.dof.ca.gov/research/demographic/reports/projections/P-2/

4.3 Industry and Employment Data by Service Territory

While population growth provides an indication of the overall numbers of people expected to reside in each utility service area, considering growth in employment by industry type allows for an understanding of what types of business spaces will need to be built. According to California's Employment Development Department (EDD), the largest growth rate from 2010 to 2020, is forecasted to be in the following industries: construction (expected to increase 26.2 percent), educational and health services (25.6 percent), leisure and hospitality (25.5 percent) and professional and business services (23.3 percent). Federal government jobs are estimated to decrease 13.7 percent. Figure 4-4, Figure 4-5, and Figure 4-6 exhibit the EDD employment projections by sector for each IOU in 2010 and as projected for 2020.

Figure 4-4: Employment in PG&E Service Area, by Industry, 2010 and 2020[23]



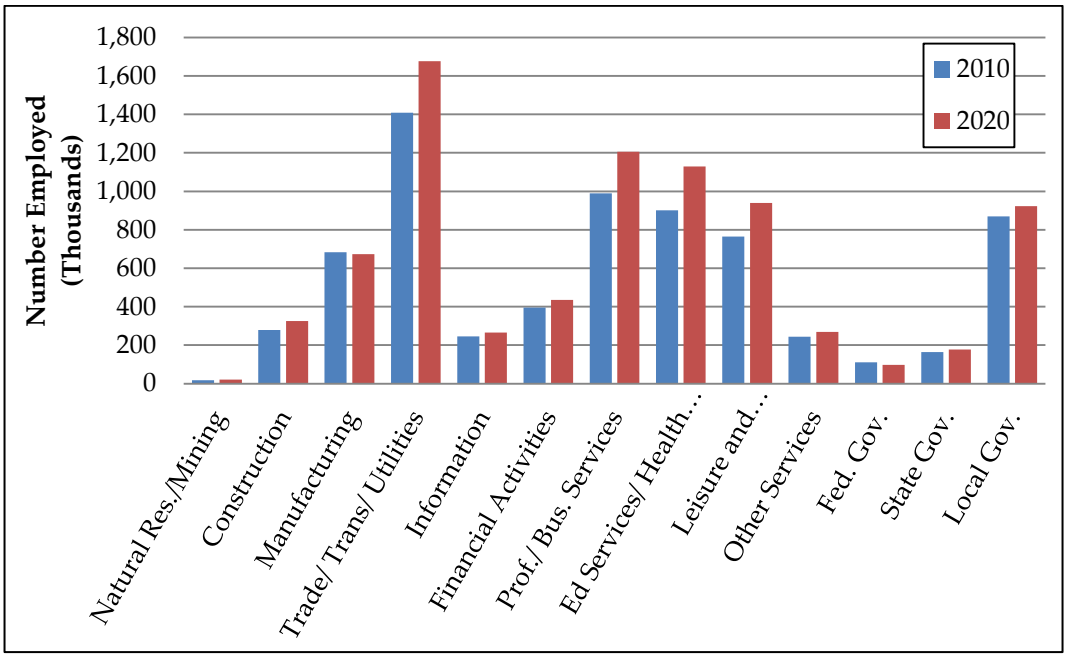
Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

As can be seen in Figure 4-4, in PG&E's service area the industry sectors with the largest growth rate from 2010 to 2020 are forecasted to be: professional and business services (increasing 23.7 percent), followed by information services (up 22.2 percent), educational and health services (20.5 percent), and

[23] Data for Alpine, Amador, Calaveras, Mariposa, Tuolumne, Butte, Colusa, Glenn, Tehama, Fresno, Del Norte, Humboldt, Lake, Mendocino, Kings, Lassen, Modoc, Nevada, Plumas, Sierra, Siskiyou, Trinity, Madera, Merced, Monterey , Napa ,San Joaquin , San Luis Obispo, Santa Cruz, Shasta , Solano, Sonoma , Stanislaus , Sutter and Yuba Counties are for 2008 and 2018 rather than 2010 and 2020.

construction (18.1 percent). Federal government jobs are estimated to decrease 8.1 percent, losing 9,400 jobs.

Figure 4-5: Employment in SCE Service Area, by Industry, 2010 and 2020[24]

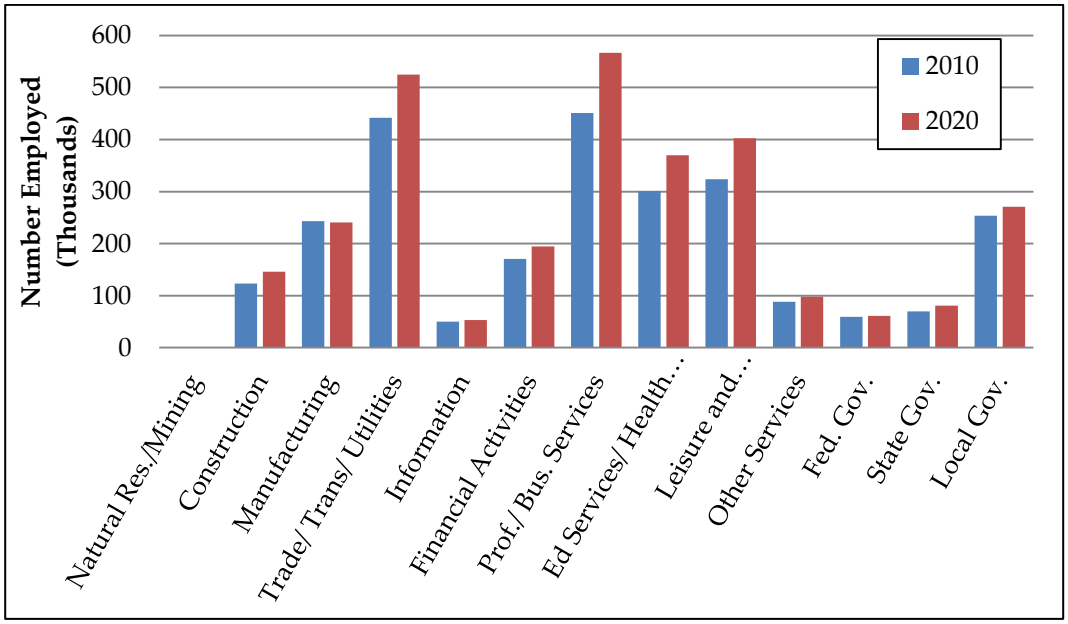


Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

As can be seen in Figure 4-5, in SCE's service area the industry sectors with the largest growth rate from 2010 to 2020 are forecasted to be in the following areas: educational and health services (25.3 percent), leisure and hospitality (22.7 percent) and professional and business services (21.7 percent). Federal government and manufacturing jobs are both expected to decrease, dropping 11.3 percent and 1.3 percent, respectively.

[24] Data for Alpine, Inyo, Mono and Ventura Counties are for 2008 and 2018 rather than 2010 and 2020.

Figure 4-6: Employment in SDG&E Service Area, by Industry, 2010 and 2020



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

As can be seen in Figure 4-6, in SDG&E's service area the industry sectors with the largest growth rate from 2010 to 2020 are forecasted to be: professional and business services (25.6 percent), leisure and hospitality (24.5 percent), and educational and health services (22.8 percent).

5. Program Best Practices for Meeting Challenging Market Sectors

In this chapter we explore best practices of NRNC programs. This discussion of best practices in this chapter does not imply that best practices are not already employed by the SBD program. In fact, SBD is highly regarded as a leading and trend setting program that is already exhibiting many if not all of the components of successful NRNC programs. However, it is useful to review the key parameters that make leading programs like SBD successful so that one does not lose sight of those features that must continue to be encouraged for future advancement of the program. This section builds upon the accomplishments of SBD and explores innovations and updates that are proving successful across North America.

The summary of program best practices that is presented here was developed through a review of the conclusions from the interviews performed in both phase I and II of this study. Interviewees referred to in this chapter include SBD program managers and staff, SBD participants, program staff, industry experts and managers from other best-of-breed programs across North America. Program best practices have been roughly grouped into four main categories: marketing and outreach, program design, program implementation and green certifications and ZNE. Within this chapter, best practices will be discussed for each of these categories leading to an ultimate conclusion of how to employ these best practices to reach each of the priority building sectors identified earlier in this report.

5.1 Marketing & Outreach

The majority of the design team interviewees have been participating in SBD for many years with the general sentiment that, once they heard about the program and participated, they have tried to use the program for any project that may qualify. Most building owners heard about the program from the utility directly and many said that the good relationship they have with utility representatives have made it possible for them to learn about programs that will help their project needs. One developer for a community college in San Diego said that when the school received bond money for improvements, a SDG&E SBD program representative contacted them directly to offer assistance. The developer had never heard of SBD before and this direct contact with the representative made it possible for them to implement many energy efficient features.

Unlike existing buildings where a project might be completely focused on an efficiency goal, new construction projects occur on their own timeline and budget regardless of the availability and offerings of an energy efficiency program. Additionally the people making the decisions in the design phase may not be motivated or compensated to include energy efficiency in the design. Marketing and outreach efforts must therefore answer the question of why bother. Interviews with subject experts offer the following strategies to connect with the decision makers on NRNC projects:

- Focus efforts on design teams.
- Develop strong relationships with professional communities by attending and presenting at trade meetings such as AIA and ASHRAE conferences.
- Actively train architects and engineers through sponsoring or delivering training opportunities and presenting substantive case studies that offer details that can be referenced and innovative design concepts.

- » Proactively reach out to top design firms and the largest electric customers such as universities, school districts, hospitals and large manufacturers. Some programs are using dedicated Account Managers to interact with these key customers.
- » Leverage the non-energy benefits of participation to both design teams and building owners.

Since building owners don't typically understand the benefits of program participation nor do they understand the process of program participation, the focus of program marketing and outreach needs to be on developing long term relationships by providing excellent customer service to the architectural and engineering communities. Additionally, incentive dollars are quite modest in comparison to overall design and construction costs, our subject experts have suggested that leading with non-energy benefits before promoting energy efficiency can be productive. SBD can market the program by indicating to architects and engineers how working with the program increases business opportunities. For owners, another major advantage of SBD participation is that it provides third party verification of energy efficiency which can result in increased occupant satisfaction, resale value or green marketing can be substantial motivators.

5.1.1 Incentives and Public Recognition

Central to an efficiency program is its incentives and the incentives' ability to influence both participation and standard business practices. Navigant queried both owner representatives and design team members on their impressions of SBD incentives for the current market cycle, which resulted in the following key insights.

- » Design team incentives are important in encouraging high-performance design practices.
- » An owner or design team member who supports prioritizing energy efficiency can leverage incentives to convince other stakeholders.
- » In LEED buildings incentives were seen to drive the building towards more efficiency points since they resulted in a "double bonus" of both LEED points and SBD incentives.
- » End use monitoring incentives are popular with a small segment of the market interested in robust data to inform which practices work best in the field.
- » Participants are interested in new incentive strategies related to ZNE.

The building owner and design team members interviewed appreciate the incentive money and understand that it allows them to go after energy additions and improvements that they may not have originally made it into the project budget. They saw high value in incentives directly related to the design process. Design teams are currently working in an extremely price competitive environment with little ability to incur fees for any design work above and beyond standard practice. One design team member interviewed mentioned they typically only suggest participation in SBD when they believe the project can meet minimum criteria for a design team incentive. However, some building owners appreciate that incentives allow them the opportunity to spend more time on energy efficiency.

The financial assistance a building owner receives from either the Whole Building or Systems Approach was seen as the primary strength of the program and linked directly to participation rates. An owner's representative seeking funding for their project may be able to increase funding if it will generate incentives, or the incentives may allow for additional efficiency measures to be included. For public projects the incentives may be designed in from the beginning as the project relies on both the upfront

incentive as well as the life-cycle cost benefits in the original funding. One owner expressed that the incentives were an influential "hook" to get them involved in SBD; once they participated they saw the real benefit is the long-term savings achieved from the design and installation of the energy efficiency measures. However, some design team members said the Whole Building incentive did not influence their actual design, as they would be placing just as high of a priority on efficiency if the Whole Building Incentive were not available.

There is interest in pursuing ZNE buildings but also increased risk and financial challenges. An incentive specifically tailored towards ZNE that helps balance the risks of attempting new technologies would be beneficial to the market. ZNE tends to have less favorable returns on investment so additional financial assistance would help convince those considering becoming an early adopter of ZNE.

Enhancing or applying these motivations of incentives and public recognition to new applications is one way that leading programs have further transformed their markets. Surveyed programs indicated the following successes:

- Encouraging early enrollment by providing increased early design support
- Offering an incentive for energy modeling
- Offering a best-of-breed awards program to increase recognition for innovative designs and building practices
- Supporting LEED buildings in their entirety, not just Energy and Atmosphere Credits

Both Energy Trust of Oregon and Efficiency Vermont are in the process of repositioning their programs to provide more early design support. Energy Trust of Oregon provides a $2,500 incentive at the beginning of a project in order to assemble the entire team and set an energy goal. This meeting also allows an opportunity for tools to be introduced and for the owner to advocate their commitment to the energy goal. Efficiency Vermont will be limiting those projects that enroll late in the design process to less generous prescriptive incentives.

Through a Request for Proposal (RFP) process, New York State Energy Research and Development Authority (NYSERDA) selected seventeen firms to provide energy modeling services for their program. NYSERDA pays the first $5,000 of the modeling costs and provides cost sharing for the balance. Through this initiative, they are able to encourage smaller projects to incorporate energy modeling even if they are not pursuing LEED.

Awards programs seem to be specifically motivational for architects and engineers, with plaque programs specifically being used by both NYSERDA and Efficiency Vermont. The incentive is traditionally seen as the primary motivation for most participation, however for some owners the public awareness that comes from the award may be the ultimate goal. Whether awards recognize design teams or building owners, the program should consider what methods will reach the largest audiences and make the awards a public event.

NYSERDA has strongly supported LEED buildings by taking a holistic approach. Rather than only supporting Energy and Atmosphere LEED points as many programs do, NYSERDA believes supporting the program in its entirety ultimately results in better projects. NYSERDA asserts that their program has contributed to the demand for LEED both throughout New York and nationwide. Meanwhile Energy

Trust of Oregon had decided to base program savings off of LEED models as presented to United States Green Building Council (USGBC). While this requires Energy Trust to modify some baseline models in accordance with Oregon code, it does allow the program to leverage USGBC reviews and has increased participation by not requiring a separate model for the efficiency program.

5.1.2 Economics as a Driver of Participation

Overcoming the initial cost of many energy efficient technologies and building practices is still a major barrier. In fact many interviewees voiced that return on investment and payback periods are the number one determiner for implementing certain energy measures. In order to pursue the addition of an efficient measure within their building design, half of the ten[25] respondents required a four to six year simple payback. This was true even though interview respondents were early adopters of SBD who displayed a preference for energy efficient projects. One would expect that a more skeptical owner's representative would require an even shorter payback.

Only one owner stated that they considered overall lifecycle costs on a 20 year horizon when deciding to pursue energy efficiency. Additionally, one design team member noted that he has to educate his building owners that sometimes even though payback is long, "It is not the first cost, it's the final cost" that counts. In order for SBD to benefit from projects that include those building measures with longer lifetimes, such as thermal shell measures, building owners are going to need to have an appetite for longer payback periods and lifecycle analysis. Additionally financing solutions already available may offer options for financially challenged participants. SBD should leverage the fact that participating in the program offers design teams and building owner/developers the tools to understand the right types of measures to include in their projects.

5.2 Program Design

New approaches to program design include strategies to focus technical assistance where it can be most effective and working beyond territorial boundaries. In particular our subject experts recommended the following program design features.

- Offering a variety of program tracks that suit the needs of various participants, from large and complex projects to the small and simple projects
- Determining the design team's goals and needs early and then allocating technical support and incentives as needed
- Recognizing that architects, design firms and large owners may serve broad territories; work across service territories to coordinate offerings and goals

Currently, SBD has flexible Whole Building and Systems approaches, yet all of the leading programs surveyed additionally offer simple solutions that serve buildings with smaller design budgets. This includes offering small customized incentives focused towards standard design practices such as those offered in ASHRAE's Advance Energy Design Guides as well as prequalified prescriptive measures. While all programs encourage Whole Building and modeling approaches, there is a recognition that some buildings and design professionals would benefit from a less rigorous process.

[25] Five owner/developers and five design team members as indicated in Table 1-1.

Efficiency Vermont is experimenting with a new approach that divides projects into three levels of support based on the goals of the project. If the participant enrolls early in the design process Efficiency Vermont will facilitate setting goals and provide assistance accordingly. The categories include:

- High-Performance – For a goal of 20-30 percent better than code
- Advanced Performance – For a goal of 40-50 percent better than code
- Net-Zero Ready – Which will be a pilot program that does not require a ZNE building, but does require the team to reasonably attempt a ZNE design. The requirements of this option are still being explored.

NEEA recognizes that California IOUs are already seeing benefits from offering a common program across their territories, however, recommendations are made towards exploring the possibility of working with Oregon and Washington and providing a West Coast strategy.

5.2.1 Program Timing

All interviewees agree that the earlier they incorporate SBD into the design process, the more beneficial the program can be to the project and the easier it is for suggested energy efficiency changes to be implemented in construction. All interviewees suggested that there was benefit in SBD representatives being involved in a project as early as the first kickoff meeting so that they can understand the needs of the project and know where their assistance can be of most benefit. Early involvement allows for SBD representatives to make targeted project recommendations rather than suggesting energy measures that do not fit the needs of the project allows project design teams to include measure suggestions in their initial budget structure after performing cost/benefits tests. However, the opportunity to get SBD involved in the project early is often dependent on the awareness of the program by the owner/developer and how hard the design team pushes to get SBD incorporated into the project.

The most common feedback from design team members was that the program moves at a slow pace and it is a drawn out process to receive the incentive. Building owners expressed frustration, one citing that a project took six months after completion of the building to get closure with SBD. One design team member interviewed, noted that they make a practice of following up with SBD multiple times to ensure that submitted documents move through the program. However, it does seem to be improving and SBD is now more responsive. When probed if the timing concerns negatively affected the final design, most design team members indicated that a high level of energy efficiency was attained in the end.

5.2.2 Program Interaction with Design Teams

Navigant solicited feedback from program participant interviewees about general opinions and suggested changes to the SBD program. Design team interviewees would like to see more communication between SBD program representatives and themselves, specifically in relation to the movement of the project through the program especially at critical milestones. Design teams noted that different utilities have different requirements and check points throughout the process. More feedback from program representatives would help them to be more consistent and confident in how they navigate the program. Another design team interviewee noted that they hadn't seen much marketing or information from utilities about the existence of the SBD program and they'd like to see more interaction from the program with the design community.

Design team members overwhelmingly feel that SBD requires significant paperwork. One design team member noted that it would be easy for a project to be delayed if a design team was not persistent in turning in required documents and following up with SBD over the course of the project. Of all those surveyed, one owner's representative understood the need for the paperwork and thought the amount reasonable. Design teams felt it was sometimes frustrating to work with all the "red tape" of SBD. Additionally, they were not sure who to reach out to at the utility for help with certain types of projects. Both design teams and business owners expressed that they would be interested in a better relationship with the utility program representative to help them better navigate the process. One building owner specifically noted appreciation for the existing professional development offered though sponsored events and community information.

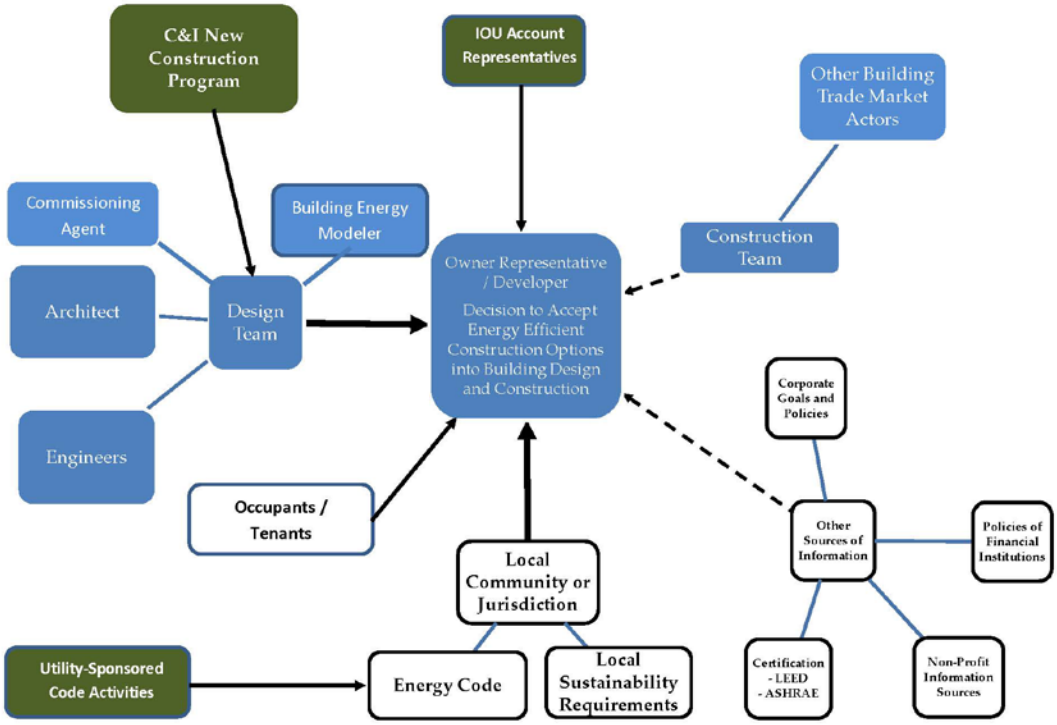
There was an impression that the current SBD offering is a "one size fits all" approach that is not meeting the needs of certain types of buildings. When an owner decides to use a Design/Build approach it is usually to cut costs and not focused on efficiency. One design team member expressed interest in bridging documents to be clearer on the energy efficiency requirements with the design of making it easier to incorporate SBD in Design/Build buildings. Small projects face a challenge since SBD is focused on modeling and there is a lack of expertise in modeling small projects. Additionally, some interviewees feel that the program is designed more for standard office buildings and doesn't incorporate specialty building designs such as laboratories or data centers. PG&E offers a separate program called Customized New Construction to assist buildings with major features not covered by Title 24.

5.2.3 Effects of Design Process and Building Complexity

Understanding the interaction between the variety of non-residential building design processes and avenues for participation in NRNC programs can be integral to understanding how much of an influence that program can have on the ultimate efficiency of new construction projects. It is widely understood and confirmed in this study that budget and timeline are the primary drivers of the design. Efficiency can only be considered when budget and timeline constraints are met. Navigant's findings agree with the *2011 SCE SBD* Study that the characteristics of ownership, occupancy and building type primarily drive whether a design team and building owner are inclined to seek out energy efficiency enhancements. Therefore, whether the SBD program process works with the building design process or not can be a driver or a barrier to participation.

To better understand the impact of industry network interactions, Navigant developed a market map, Figure 5-1, illustrating connections between the SBD program, design teams and larger design community influences. The goal of this illustrative network description is to understand the influences affecting a building owner or developer when making decisions regarding energy efficient design and construction options.

Figure 5-1: Illustrative NRNC Market Map



Source: Navigant Analysis

The market map illustrates the strength of connections between all the players who have an influence on the developer's decision to accept energy efficient construction options. As the market map illustrates, the design team and local community energy codes or sustainability requirements have a much stronger impact on the developer choosing energy efficient construction options than the building trades, or even the C&I New Construction Program. What this indicates is that in order to encourage energy efficient options, SBD must influence the design team or local jurisdictions to favor energy efficient choices.

It is important to realize the variety of contacts that utility programs must encourage in order to reach all individuals who might have an impact on the developer's decision. While the main connection is from the C&I New Construction Program to the Architect, other connections must be upheld including Utility-Sponsored Code Activities which focus on local jurisdictions, Account Representatives which focus on supply-side delivery, and Trade Ally Networks that focus on the building trades' interests. Maintaining positive relationships with all members of the market can ensure that SBD identifies any possible opportunity to influence energy efficient choices by the building developer.

By viewing the SBD program in relation to compatibility with a building's design process, SBD program managers can infer new and valuable information on the varying levels of success in each category and how to best reach new customers. This approach was discussed during interviews with Program Managers and Design Teams with the following key findings:

- The three categories outlined in *Section 2-Building Design Processes* (DBB, DBwDT, and DBwC) are accurate.
- The third category, DBwC, is the most difficult to reach because of the fast pace of these projects.
- Design/Build projects (DBwDT or DBwC) usually have a fixed budget which makes it difficult to add energy efficiency considerations. Getting the DBwC engaged in SBD early is critical for success.

All interviewees from design team indicated that they worked on projects that follow both DBB and DBwDT processes, but SBD tends to attract design teams that use DBB. In discussing SBD with the design team interviewees, who were mostly members of engineering firms, it is clear they are interested in including energy efficiency in their design process, but are very limited in budget. When the incentives are unclear it is difficult to sell energy efficiency to the owner during the bidding process, based on a projection of long-term savings. Since the DBB process tends to be extremely cost sensitive, benefits must be transparent and additional work or costs associated with energy efficiency must be minimized.

There was a consensus that the Design/Build with a General Contractor approach has been the hardest to reach for SBD. Additional recommendations for reaching the Design/Build Market are discussed in *Section 5.5.7 Design/Build Buildings.*

5.2.4 Effects of Ownership

If the building is to be designed with the oversight of the eventual occupant and owner, this represents the best case for efficiency to be taken as a serious design consideration. When a developer is designing a building for lease, especially as Class A office space, there is a growing awareness of the ability to attain and retain tenants if the building meets high levels of efficiency or "green" design. Occasionally there will be a tenant already identified that will insist upon certain efficiency goals or perhaps require a certain level of LEED certification. Regardless, the majority of the leased buildings are still more concerned with first cost than on-going energy costs, especially when the tenants will be paying the energy costs. Communicating the benefits of efficient buildings (higher rents, lower tenant turnover) to owners/landlords is important because it is not easily quantifiable by them. The projects that are least likely to be interested in energy efficiency are those being built to be sold. For these projects construction costs are the primary concern.

There was also agreement between the *2011 SCE SBD Study* and Navigant's Study that building type does impact the owner's motivation to pursue efficiency. Navigant's study found that public sector buildings are generally more likely to build to efficient standards as these owners are more accustomed to analyzing life-cycle costs than the private sector and there is more certainty that public sector occupants will occupy their buildings for a longer period of time than occupants in the private sector. Additionally, public sector buildings are more likely to have a mandated level of efficiency or LEED certification. Military facilities in particular have had high levels of participation in SBD in both the SCE and SDG&E territories. On the other hand, hospitals were found have low participation in efficiency programs even when publically owned.

Other findings regarding ownership, occupancy and building type include:

- » While developers of leased space are interested in marketing their buildings as efficient, they are more interested in the perception of efficiency than actually achieving the highest level of cost-effective efficiency features.
- » Corporate culture and owner personalities may overcome building type influences. A larger private company may have minimum efficiency standards or corporate mandates. Additionally the influence of an owner's representative who is also an advocate of efficiency should not be underestimated.
- » Data Centers were found to be a building type trending towards efficiency. As data centers are highly energy dense, this is an important trend for the SBD program to cultivate.

When considering ownership, occupancy and building type, a program designer should be aware that these factors influence how likely energy efficiency is to be considered in the design regardless of whether there is an efficiency program. The primary goal of an efficiency program should be to influence behavior beyond what would have happened in the program's absence. Navigant considers a best-of-breed NRNC Program to change behavior both in building already having high efficiency targets as well as one that may not be considering efficiency at all. For example a participant who is seeking LEED certification may have a moderate efficiency target, but the program may be able to move that participant towards achieving a higher efficiency level through incentives, technical assistance and education about the side benefits of Energy and Atmosphere points.

5.2.5 Delivery Model Impact on Energy Efficiency

A new construction energy efficiency program should not only be measured by the number of participants, but also on the amount of savings achieved at each project relative to the potential. While a thorough study of SBD's project level achievements is beyond the scope of this study, Navigant asked participants questions relating to the process they experienced while looking for characteristics of best-practice programs. This lead to the following discoveries:

- » SBD staff is making multiple contacts with participants including a kick-off meeting setting the project goals and objectives.
- » Interactions between SBD and design teams include limited in-person meetings, phone meetings and written design reviews.
- » SBD offers economic Return on Investment level analysis as well as energy efficiency enhancement suggestions.
- » When modeling was performed SBD uses the model to optimize the design suggestions based on model outputs.
- » SBD suggestions are considered, with some suggestions incorporated into the final design. SBD is seen as a valuable second opinion.
- » Multiple participants agreed they achieved higher efficiency levels from participation in SBD and that their LEED point focus shifted towards Energy and Atmosphere points.
- » Some participants value the technical assistance more than the incentives.
- » None of the interviewed participants were aware of any on-site inspections from SBD during the construction phase.

Navigant has concluded that SBD's technical support is following best-practices and is making efforts to maximize savings at each project. While this level of participant support is unsustainable if market participation were expanded to include multiple mid to small scale buildings, SBD's process is ideal for large buildings with sufficient design timelines and budgets. Navigant was unable to determine if SBD performs on-site visits during the construction phase, but recommends that on-site visits occur on larger projects. Construction phase visits are the best time to determine if the building envelope is being built to design and if there are additional opportunities for improvement.

5.3 Program Implementation

While it is critical to reach design team professionals to promote NRNC programs, they can be a difficult group to influence. Because of cost and time pressures already associated with design they are reluctant to embrace changing standard practices. Once a project is enrolled in the NRNC efficiency program, the program design must be sound and any program interactions must be positive experiences for the design team. Additionally projects must be well tracked so that future adjustments to the program can be fact based. When our subject matter experts were asked about program implementation these key suggestions were identified:

- Provide benefits and incentives rather than penalties.
- Leverage an efficiency advocate who is either an owner or design team member.
- Attract and retain the best personnel to work on NRNC projects and allow them to work in a flexible environment.
- Focus on the participant's perspective and provide quality customer service.
- Ensure the tracking database records key parameters.

A building owner or a design team member should only perceive benefits by participating with a program like SBD. For example, a program that encourages integrated design will realize material savings such as right-sizing mechanical systems to match improved thermal shells. A program should use additional incentive mechanisms to push the market towards program participation and encourage best practices for efficient constructions. Examples include incentives for achieving high savings targets, LEED accreditation, performing commissioning, and installing active metering of gas and electric subsystems to be available to the utility. Additionally design tools that focus on efficiency can be made available to the entire NRNC design community. It is advised to avoid situations where a high incentive is expected by the design team, but not realized due to a small criteria failure. While the SBD program should check whether the building meets code, the design team should be assured that code infractions will not be enforced by SBD.

An effective NRNC program will recognize the natural allies they have on the design team and leverage their influence. Often times the building owner's representative will have a great vision for an efficient building but lacks the tools and knowledge to deliver that building without support. A kick-off meeting which allows an owner to vocalize a priority of efficiency to the entire design team and introduce a relationship with the efficiency program providing a framework for success. If a productive relationship with the owner isn't possible, there may be another efficiency advocate to leverage on the design team. It is important to identify these advocates and to be a partner in their efforts.

Energy Advisors working on NRNC programs are dealing with more complexities than those working on existing buildings. The advisor has to be fluent in all of the technologies contained in non-residential buildings, have a thorough understanding of building code, influence contractors who are skeptical of the advisor's competency, be able to work within the short time frame allowed for design decisions, and compete with larger project concerns than efficiency. This challenging task requires Energy Advisors who are experienced in NRNC design process, understand efficiency technologies, and have the people skills to influence design teams. Good staff should be encouraged to become NRNC experts and should be provided training specialized for NRNC markets. Additionally, every effort should be made to retain these specialized staff members in order that they can participate in long NRNC project cycles.

A primary trend noticed across all of the surveyed programs is a focus on the participant design teams to provide a custom solution as often as possible. The programs also tend to view projects holistically, recognizing a program is not going to be successful if the goal is limited to energy savings. Additionally, programs like New York State Energy Research and Development Authority (NYSERDA) have found success allowing their Energy Advisors flexibility so that advisors can short-cut programmatic bureaucracy and provide flexible incentives tailored to each project's needs. The ability to accelerate the project within NYSERDA or honor a specific request of the design team has led to increased program satisfaction of participants

Tracking systems are key tools for planning future program design enhancements. Tracking of key information such as accurate project savings, accurate building types, square footage of finished space, and whether the project was a new building, an addition or a gut-rehab are essential if accurate market analysis is to be performed. Additionally a robust tracking system can be used to identify marketing opportunities, share information between program staff interacting with the same market actor, and identify opportunities to increase participation. For example, Efficiency Vermont's tracking database allows for tracking of each NRNC market player as well as each NRNC project, and the system can link each player to the projects they have completed. NYSERDA is starting to employ a secondary system to accomplish some of the same tasks that Efficiency Vermont's internal tracking system performs.

5.3.1 Quality Control and Verification

The longevity and acceptance of energy efficiency programs is dependent on their ability to reliably predict energy savings and verify results. New construction programs, because of their complexity and lack of a measurable baseline are particularly susceptible to criticism of savings claims. Leading programs will ensure high levels of quality control and insist on rigorous verification. Recommended procedures from our subject matter experts included the following:

- Collect and file a complete set of project files clearly detailing how savings were attained. Best practices include having a project summary that explains the high-level approach, history and assumptions of the project. All materials required to recalculate savings should be collected, which typically includes any lighting layout drawings, mechanical specifications, thermal shell details and specifications and copies of both the as-built and baseline energy models.
- Provide clear simulation guidelines to build models and interpolate results. These guidelines will help to increase model accuracy and the uniformity of the approach. Additionally, require the collection of executable modeling files for both the efficient and baseline cases.
- Include active metering over multiple years to ensure buildings are performing as designed.

» Require a review process for all completed projects, but focuses resources on larger and more complex projects. Reviews can vary from a simple peer review, to a multi-layered review including peers, technical managers, business managers and internal quality control personnel.

New construction projects tend to span multiple years and are more comprehensive and complex than typical retrofit projects. While many of the quality control recommendations are pretty standard for new construction energy efficiency projects, metering has been challenging for new construction efficiency programs since results are difficult to compare to a baseline and are highly dependent on weather and occupancy. While none of the programs interviewed has had a definitively successful metering program, NYSERDA, Efficiency Vermont and NEEA have considered and tested metering efforts. Lessons learned include focusing on a few case study buildings, getting permission to have access to data over multiple years, and normalizing data relative to occupancy and weather. Models can also be improved in some areas such as predicting the performance of commercial kitchens. Completion of a few robust studies could improve the accuracy of building energy modeling.

5.3.2 Technical Training and Account Management

Beyond incentives and awards, which tend to increase enrollment, providing, specifically the largest customers the opportunity for energy efficiency training in order to understand their needs before a new building is considered will further transform a market and provide repeat participants. Trends in the surveyed programs include the following:

» Working closely with large design firms to transform recognized best-practices
» Developing in-house design guides for medium complexity buildings or buildings using a design-build approach
» Offering a builder's conference focusing on efficient design
» Providing Efficiency Account Managers and Technology Leads

NEEA had a program called "Firm Focus" which allowed them to work intensely with five to six large, influential firms that represented a large percentage of the new construction market. The idea was that transforming the practices of leading firms could provide a beneficial example for smaller firms. NEEA moved personnel into the firms to provide services including technical assistance, staff training, development of analytical tools, and support in providing a business case to sell high-performance to building owners. $100,000 was allocated per firm over three to five years.

Recognizing the need to provide an efficient guide for standard buildings that don't need full custom assistance, Efficiency Vermont developed an in-house guide based off of Core Performance, ASHRAE 189.1 and ASHRAE's Advanced Energy Design Guides. The Efficiency Vermont guide is called, the "High Performance Design Guide," and can act as a standalone for self-directed design teams or can be used as a starting point for many other buildings where full interaction with Efficiency Vermont is desired.

A unique offering of Efficiency Vermont is an annual builder's conference called "Better Buildings by Design." This two-day conference is the region's largest conference devoted to energy efficient building practices. It serves as a vehicle for the design community to showcase their work and suppliers to present their technological solutions. Efficiency Vermont uses this event to educate the design community and also provides a public forum to present the "Best of the Best" building awards to

various categories. For a state with a small population, 600,000, Better Buildings by Design attracts around 1,100 participants. The conference could, however, be scalable to larger markets with smaller regional or perhaps multiple conference offerings per year.

Another form of technical assistance offered by Efficiency Vermont is their Efficiency Account Managers and Technology Leads. Efficiency Account Managers work with the largest customers such as universities and larger manufacturers. For each of these large customers there is an assigned Efficiency Account Manager who can help them look at long range energy use and identify potential projects. These account managers do not have supply side responsibilities and focus entirely on efficiency and demand side management. They prove to be useful both in generating projects for existing buildings as well as new construction. Additionally, Efficiency Vermont employs dedicated Technology Leads for technologies such as: lighting, HVAC, refrigeration, industrial process, etc. Technology Leads help determine how they to deliver and incentivize improved, new technologies. NYSERDA has a similar group for industrial process technologies.

5.4 Green Certifications and Zero Net Energy

California's Efficiency Strategic Plan, published in 2008, sets some large programmatic goals, called the Big Bold Energy Efficiency Strategies (BBEES) for energy efficiency. Of these four BBEES, the one which affects the SBD program to the greatest extent is the goal that all new commercial construction in California will be ZNE by 2030. As the market begins to move towards ZNE in response to this goal, SBD will have to transform its program requirements in order to not be left behind. As such, Navigant focused interview questions on the effects of increasing codes, interest in green certifications and the opportunities for ZNE to better understand the role of SBD in this changing market.

5.4.1 Green Certifications

Navigant explored the influence of green certifications on energy efficient construction decisions by asking interviewees about their experience with green building certifications including LEED, Collaborative for High Performance Schools (CHPS), Energy Star and CALGreen. For both design teams and building owners/developers, LEED certification was a common framework used to obtain the specific energy efficient aspects of their buildings and increasingly owners are interested in obtaining LEED-certified buildings, especially owners of apartment complexes, office buildings, public buildings, schools and hospitals.

The energy components of LEED certification provide a starting point for many SBD construction projects and even if the building did not officially obtain LEED status, the project often shadowed LEED requirements to meet energy efficiency goals. Typically, it is the owner that makes the decision to pursue LEED certification, as well as the other green certifications, as they are the individuals who primarily benefit from positive public relations and collect any incentive money or certification. Building owners find that SBD incentive money helps solidify their decision to pursue LEED or another green certification as it gives financial flexibility for the project to include extra steps that may be needed to become certified.

While many energy efficiency programs across the U.S. use LEED standards as a basis for the development of their efficiency goals, NYSERDA goes beyond this use of LEED and provides full support for the entirety of LEED certification. Pushing beyond the Energy & Atmosphere points to supporting the entire LEED program requires focus and knowledge, but can result in a market

transformation towards LEED buildings. Any support that is provided by the program towards all of LEED's design goals can help to capture new design audiences, those that aren't first interested in energy efficiency, and move their interest towards program requirements.

CHPS was a popular certification among both design teams and building owners who participate in school construction. The design teams noted that it's a useful certification to motivate school districts to do more with energy measure implementation. School developers appreciate the extra incentive that opens up new construction opportunities. Altogether, CHPS is a popular certification for many schools in California.

5.4.2 Zero Net Energy

Navigant focused interview questions on the ability to build towards ZNE and the effect of codes requiring ZNE. The findings from these specific interview questions include:

- Currently, there are very few ZNE projects, but the expectation is that NRNC ZNE projects are likely to become more numerous.
- ZNE is more attainable for certain types of buildings.
- Technology advances will be required to reach ZNE in all building types.
- Multiple building owners interviewed expressed a desire that their own economic reality should be driving the push towards ZNE rather than energy code.

The utility program managers predict that, as ZNE codes become imminent, the commercial sector will be better positioned to achieve compliant ZNE building. However, the residential sector is expected to lag behind the commercial sector. If true, this may represent an opportunity to leverage the abilities of early commercial sector adopters to prove the feasibility of ZNE for all buildings.

To maximize the cost-effectiveness of ZNE design, energy efficiency within buildings should be improved to the point where adding more efficiency would be more expensive than adding on-site renewable generation. Realizing that wind and small-scale hydraulic power will not be fruitful at most sites, ZNE goals currently encourage a reliance on solar. Large high-rise buildings face a challenge by not having enough area to house solar panels to offset the remaining consumption of an energy efficient design. Energy dense building types such as hospitals and data centers[26] would find it more difficult to reach ZNE than other building types.

The general consensus is to reach ZNE, technology advances, mostly in renewable generation, would be required. Additionally, renewables are still viewed as cost prohibitive by at least one building owner interviewed. One additional expert interviewed felt that ZNE is more attainable when considering all

[26] ARUP. *The Technical Feasibility of Zero Net Energy Buildings in California.* December 31, 2012. This 2012 study documents a "stress test" of California's new Zero Net Energy (ZNE) construction goals which set a 2030 target for all commercial new construction to reach ZNE. While it was determined that the technical feasibility exists for most building types to reach ZNE, there are some commercial buildings where the goal might not be reasonable. Specifically, those heavily energy intensive building types, such as restaurants, grocery stores and hospitals just don't currently meet the test for the technical feasibility of ZNE.

new buildings in aggregate where some buildings would be net consumers and some would be net producers.

Regardless of the direction, stringent energy codes are never popular among the building community. However, there is little doubt that an energy code trending towards ZNE will have a positive effect on reducing the energy consumption of commercial buildings. Questions still remain as to the cost of achieving ZNE and how to equitably address different building configurations and types.

Both NYSERDA and Efficiency Vermont are in the process of developing pilot projects regarding ZNE buildings. In both cases the programs allow the clients to define the goals of their projects and are supporting them in their path towards ZNE. Energy Trust of Oregon has already run a pilot on ZNE, which began in 2009 and found that the most important piece is to focus less on the rigidity of the goal, but to help the customers on their path to ZNE. The concern about achieving ZNE at the completion of the project is a real concern for participants, and it should not be the primary focus for the program as long as significant savings are achieved. Other lessons learned in Energy Trust of Oregon's pilot include the following:

- Take the Zero out of ZNE.
- Provide large incentives but hold participants accountable.
- Be prepared for longer timelines and financing challenges, specifically connecting private developers to the lending community that might balk at unproven results.
- ZNE is more about the collaborative design and less about the individual technologies. Since participants are attempting to deliver a goal that is not yet proven in other buildings, a higher level of support can be seen as equitable for these building projects.
- The efficiency program can play an important role in assisting with marketing. Marketing can also reduce the perception of risk by providing proven examples of ZNE and increase the possibility of future ZNE projects.

Participants want to be flexible with how they make their decisions and don't want to risk falling just short of ZNE. Facing the practicality of the current situation, efficiency programs are attempting to promote ZNE design without strictly requiring ZNE performance. Energy Trust is calling their program "The Path to Net-Zero" and will allow design teams to set individual goals. From Energy Trust's perspective, these goals would ideally be somewhere around 50-60 percent better than code. Efficiency Vermont is taking a similar approach calling their program "Net-Zero Ready".

Energy Trust began their pilot program to try to determine if ZNE was more about the design process or the technologies. Ultimately, a ZNE design process was found to be more important, and that some of the individual technologies were not passing cost-effective screening tests. Efficiency Vermont agrees that the focus should be on the design and a significant focus needs to be placed on incorporating ZNE goals early and collaboratively. NYSERDA has had trouble with ZNE projects passing cost-effectiveness screening tests and believes ZNE is not compatible with the conventional Total Resource Cost (TRC) tests.

Award competitions focusing on ZNE may prove to be influential in further transforming the market. Efforts like PG&E's Architecture at Zero[27] program should be continued and expanded.

5.5 Barriers and Solutions to Savings By Design Priority Buildings

The drivers and barriers to participation in SBD as mentioned in the interviews and discussed in this chapter are worth repeating as they provide the best insight as to the opportunities and challenges for SBD. These drivers and barriers are listed in Table 5-1, below.

Table 5-1: Drivers and Barriers to Energy Efficiency in California

Drivers	» Achieving a green or efficient certification and the associated positive marketing » The potential to receive incentives for both the owner and the design team » Saving on the lifecycle cost of ownership » Realizing the non-energy benefits of highly performing buildings
Barriers	» The cost of the energy efficient measure, developing an energy model and undertaking a more detailed design » The perceived need for short payback periods » The complexity of the program and the need for participant education of the process » The timing and speed of intervention with the design process » The willingness of the design team to collaborate with each other on an integrated design as well as be fully engaged in promoting and designing energy efficiency » Serving the needs of accelerated design processes such as Design/Build projects, small and medium projects or "non-standard" buildings » The ability to adjust the budget once financing is secured

In interviews with subject matter experts, Navigant discussed barriers and solutions for the two priority building segments identified for each IOU in *Section 3 – Program Market Penetration and Savings Potential,* as well as other building classifications widely understood as difficult to penetrate with a new buildings efficiency program. High potential building segments across utilities include office, retail, restaurant, school, manufacturing, laboratory, and warehouse buildings. Other important building classifications discussed include Design/Build buildings, national chains, leased spaces, and medium to small scale buildings.

5.5.1 Office Buildings

All of the programs interviewed receive more savings from office buildings than any other building market sector. Energy Trust of Oregon has found success in offering a per square foot incentive based on the inclusion of a standard set of efficiency approaches. Efficiency Vermont used to offer a per square foot incentive, but has migrated away from that approach because it was not flexible enough to handle participant goals and expectations.

Those surveyed agreed that the key to driving offices to higher levels of participation required focusing on occupant satisfaction. This requires making a connection to the occupant's needs and desires as well as presenting to the owner the non-energy benefits of high-performance buildings. It helps to have very

[27] Architecture at Zero is an annual design competition administered by PG&E. More information on the design competition can be found at http://architectureatzero.com/.

specific examples of occupant benefits, but in general these buildings tend to drive higher occupancy and market values as well as increase productivity and employee retention. Getting deeper savings out of enrolled buildings is usually driven by connecting with an efficiency champion on the design team; ideally this champion would be the owner.

5.5.2 Retail Buildings and National Chains

Retail buildings tend to be characterized by a high potential for lighting savings and a large number of national chains or franchised stores. This market tends to be difficult to penetrate as it tends to be less focused on energy than other markets and many chain or franchise owners utilize national design templates that are difficult to modify.

Retail stores have relatively high code allowances for lighting power density and as such lighting savings should be the focus. Efficiency programs will not be successful unless they can deliver a perceived increase in lighting quality, and therefore these buildings are good candidates for increased Light Emitting Diode (LED) fixture penetration. Energy Trust of Oregon has found success, especially in chain stores, in offering full-scale lighting mock-ups at existing stores. This strategy can also work in grocery stores for both lighting and non-lighting measures.

When dealing with a national chain or franchised store with a standard design, it is important to reach the national headquarters. NYSERDA has sent staff to Walmart's headquarters in Iowa to discuss efficiency options and NEEA has offered large property owners the technical support to come up with new building templates. In some franchised stores the national company does not pay for energy use and is therefore less motivated to pursue efficiency. In these cases some of the strategies discussed later in this section for leased buildings may apply.

5.5.3 Restaurants and Commercial Kitchens

Restaurants tend to face many of the same efficiency challenges that retail stores do, but are also characterized by the addition of an energy intensive commercial kitchen.

Commercial kitchens exist in a variety of building types of interest to SBD. There are almost 40,000 restaurants and bars in PG&E's service territory, and there are another 10,000 commercial kitchens in other institutional buildings like universities and prisons. Commercial food service components can also be found in other sectors such as K-12 schools, supermarkets, large office buildings and hotels. Due to the prevalence and high energy intensity of commercial kitchens Navigant contacted a subject matter expert on commercial kitchen efficiency, Don Fisher of Fisher-Nickel, Inc. Additional information on commercial kitchen efficiency is provided in the literary review, *Appendix A – Literary Review, Section 9.8*.

Key recommendations from Don Fisher, specifically for restaurants and commercial kitchens, include the following:

- Understand how the restaurant market is divided and how to reach the key players in all areas.
- Expand educational efforts to promote the benefits of energy efficiency.
- Provide a robust set of prescriptive rebates covering nearly all equipment categories.
- Ensure the program is embracing new key technologies.
- Leverage the restaurant's desire to market themselves as "green."

» Consider establishing a rating system for commercial kitchens.

The restaurant market can generally be divided into institutional, restaurant chains and independent restaurants. In institutional food service the architects typically partner with food service consultants who usually are not aware of SBD. To achieve better savings in institutional kitchens the program should focus on engaging these consultants. Food Service Consultants International is a national organization that needs to be connected to SBD.

Restaurant chains typically hire low bid Architecture and Engineering (A&E) firms, but some have a corporate architect or engineer. Low-budget engineering firms do not budget for additional design work related to efficiency and are typically not willing to spend money on new designs. Possible avenues for reaching chains would be to offer prequalified equipment packages which could reduce complexity and underwrite the engineering design costs if they could be replicated across enough stores in California. Additionally, case studies can be effective selling tools for restaurant chains. Another sector of the restaurant chain market, franchised restaurants are particularly difficult to reach as slight increases in construction cost can significantly impact the cost of the franchise agreement.

Independent restaurants are typically designed by product dealers and the owner's typically don't have the technical knowledge or availability to investigate new practices. To reach this market a program has to influence the dealer and design network. FishNick is working on this approach with PG&E by providing a point of sales rebate for food service equipment.

While education and outreach to restaurants and commercial kitchens has increased significantly over the past five years, there is still a need for increased education. Culturally, the industry generally requires a two-year payback scenario, which is driven by first-cost barriers and low confidence in savings predictions. Additionally, there is a perception in the food service industry that efficiency benefits come at a performance cost, even though in most cases this is not true[28]. Further engaging in educational programs can help transform the market to accept longer payback terms and appreciate performance advantages. Training needs to focus on reaching wider audiences, and one example is the website FishNick is currently developing for PG&E customers.

FishNick's experience with restaurants is that they will embrace simple lists of efficient kitchen equipment. A strategy which incorporates a checklist of prequalified products and provides associated standard incentives may prove to be effective in reaching this market. Examples of equipment that could be offered prescriptively include: range burners, ovens, broilers, reach-in refrigerators, ice machines, and efficient pots and pans. Additionally, a sample kitchen design with multiple measures could be bundled as a single package and replicated across several commercial kitchens. Energy Trust of Oregon notes that there is a high potential of savings with equipment, but a utility probably needs to pay a higher incentive to convince the skeptical restaurant industry to change their practices.

Technologies that Don Fisher typically recommends include efficient walk-in coolers and freezers, demand controlled ventilation and LED lighting. When it comes to walk-ins there is substantial energy savings potential, but not a great understanding of how to quantify the savings. Don believes investment

[28] One example given by Don Fisher is an 80,000 BTU/hr. Energy Star fryer outperforms in terms of pounds fried per hour and temperature uniformity a 120,000 BTU/hr standard fryer.

is needed to characterize the available technologies and determine whether incentives should be offered for the range of possible efficiency measures. Kitchen hood demand controlled ventilation has been around for thirty years and the savings is substantial, but since the cost of these ventilation systems is considerable, they have had difficulty penetrating the market. There also are problems with lack of training and maintenance where some systems get disabled regardless of the savings. But once Demand Control Ventilation (DCV) is understood and used correctly, they can be popular systems. Finally, LED lighting is one energy efficiency measure the restaurant industry is popularly embracing, perhaps faster than any other building sector. By having a robust LED offering SBD may be able to generate positive momentum in restaurants that may carry over into other energy areas besides lighting.

The food service industry has demonstrated a desire to market themselves as sustainable and "green". As LEED buildings were gaining traction, chain restaurants such as Starbucks and Yum! Brands (Kentucky Fried Chicken, Taco Bell, Pizza Hut) have embraced LEED certification. LEED also fits in with other food service initiatives such as Farm to Fork. This enthusiasm towards sustainability represents an opportunity for SBD to improve their penetration in the restaurant market. SBD could help encourage the trend towards LEED buildings by providing tools for better energy modeling. SBD could also help participant restaurants to market themselves as sustainable.

There is a renewed enthusiasm for benchmarking and restaurant specific organizations are supporting Department of Energy benchmarking efforts. California is well positioned to lead the country in this effort.

5.5.4 Schools, Colleges, Universities and Libraries

Energy efficiency projects involving primary schools, secondary schools, colleges and universities have the advantage that these institutions will often consider lifecycle cost analysis and typically want to be perceived as environmentally conscious. However, these institutions also have unique processes and the successful efficiency program will understand and work within those processes. It is important to make the right connections at the critical times within budgeting cycles. In many cases there are also bonding issues to consider. For these reasons both Energy Trust of Oregon and Efficiency Vermont use and recommend an account management approach. Energy Trust recommends drawing a direct financial connection to each measure to limit value engineering of efficiency measures. It is advisable to be aware of any limitations on contractor selection which may hinder new and innovative designs.

Libraries do not provide many opportunities for savings, but they are often showcase projects that can easily be encouraged towards LEED and higher levels of efficiency.

5.5.5 Manufacturing Buildings and Laboratories

Manufacturing facilities are energy intensive buildings that are typically dominated by process loads. Process efficiency is often the most difficult to analyze and verify and, therefore, utility staff with technical expertise and experience are required to handle these projects. NYSERDA has a separate program called "Industrial Process Efficiency" that specializes in these opportunities for both existing buildings and new construction. Their approach partners utility process efficiency with new construction specialists to deliver high-quality technical assistance. Energy Trust of Oregon and Efficiency Vermont stress developing personal connections with owner and making connections early for small, growing businesses.

Laboratories represent another energy intensive building type with specialized technologies. An approach modeled after Fisher-Nickel's commercial kitchen program may work well with these buildings. Perhaps the My Green Lab organization could be expanded in this manner.

5.5.6 Warehouses

Warehouses were not priority buildings for any of the best-of-breed programs interviewed. While there is considerable building area devoted to warehouses, they typically are low-energy density buildings, unless refrigerated. However, since not much attention is paid to these buildings they tend to be poorly constructed. Navigant recommends marketing and outreach efforts to the major owners of warehouse buildings. Additionally, the warehouse market should be segmented according to energy density, separating out the buildings that are conditioned.

5.5.7 Design/Build Buildings

Design/Build projects are particularly challenging because of the speed at which they move. Additionally, the focus of the design team is often not on energy efficiency. Traditional approaches that rely on building energy modeling or custom analysis do not typically work with the timeline or budget of Design/Build projects. From the subject matter experts interviewed, a consistent theme was found towards allowing the Design/Build firm flexibility to work mostly independently of the utility. For this approach to be effective the utility would have to provide enough generalized technical support and education so that Design/Build firms understand and easily incorporate efficient technologies.

NEEA has considered approaching these buildings on a performance contract basis where the Design/Build firm is locked into a performance goal and then allowed to work towards that goal. NEEA also believes this market can be handled by providing a comprehensive list of prescriptive measures from which the Design/Build firm can choose.

Efficiency Vermont has assigned an Account Manager to identify Design/Build opportunities and be a single point of contact with Design/Build firms. The account manager also engages with the market to understand the needs of Design/Build projects and provide a program responsive to those needs. As mentioned earlier Efficiency Vermont offers a variety of design guides that allow Design/Build firms to work somewhat independently of the utility.

5.5.8 Medium to Small-Scale Buildings and Additions

Medium to small-scale buildings and additions are important because of the volume of these projects in the marketplace. Because of the sheer number, these projects should be targeted by a new construction program. They tend to use Design/Build approaches including Design/Build with contractors discussed in *Section 2.1 Design-Build with Contractor.* The subject matter experts interviewed all agree that providing flexibility, having prescriptive measures, and simplifying the approach are essential components of addressing this market. NYSERDA asserts that some of the small buildings they have interacted with are exemplary and can carry a strong positive message to the larger marketplace.

Originally Energy Trust of Oregon had limited success running a Small Commercial Efficiency pilot that provided resources, including the Core Performance guide, for market actors to pursue efficient design on their own. The Core Performance Guide by itself did not seem to be influential for these buildings as participants did not appear to utilize the provided tools to evaluate energy performance during the design process. Energy Trust learned that instead, providing a per square foot incentive worked well.

The incentive allowed the owner to set a target and keep measures from being value engineered out of the project. Energy Trust also realized that while many of the smaller buildings are not straight forward, they did not warrant a full custom model. Instead they created preapproved packages of measures with good, better, best options. There are packages of measures for office, retail, restaurant, multifamily, grocery, and primary schools which target 5-20 percent savings for buildings between 5,000 and 70,000 square feet.

5.5.9 Leased Buildings

It is particularly difficult to incorporate energy efficiency in leased unless the developer is targeting Class A office space and efficiency or LEED is part of the objective. In most situations the developer is targeting low-cost, rentable space and since the developer is not paying for energy use there is little motivation to pursue efficiency. There tends to be a disconnection between the streams of decision making. NEEA and Efficiency Vermont have focused on these buildings by reaching out to commercial real estate companies.

Efficiency Vermont hopes to do some pilot projects, build educational opportunities and perhaps benchmark buildings within a real estate company's building portfolio. Benchmarking in particular may be a positive vehicle for efficiency, if the rated efficiency of a building could be leveraged to effect market value or occupancy rates of leased space.

6. Conclusions and Recommendations

The primary goal of this study is to provide SBD program managers with the information they need to help enhance program participation. Navigant undertook the study focusing on updating the 2011 SCE SBD study and performing an enhanced analysis for PG&E and SDG&E.

6.1 Savings By Design Program Market Penetration and Savings Potential

Each participating IOU is analyzed independently for historical market penetration and future savings potential. The investigation includes a ranking of both gas and electric future savings potential by building type. Each IOU analysis is followed by additional observations including a quantification of savings potential by building design process.

Within the PG&E territory, customer participation rate in SBD as well as total program electric savings generally increased from 2006 to 2009, but then decreased dramatically from 2010 to 2012. Overall, electric savings has the potential to add four times the current program savings, and gas savings has the potential to add another 1.4 times the current program savings. The building sectors with the most remaining savings potential are "Office and Bank Buildings" and "Stores and Restaurants." These priority building sectors use a combination of DBB and DBwDTs design processes.

Within the SDG&E territory, customer participation rate in SBD as well as total program electric savings increased from 2006 to 2008, remained relatively high in 2009 and 2010, decreased dramatically in 2011, and increased dramatically in 2012. Overall, electric savings has the potential to add another 1.6 times the current program savings, and gas savings has the potential to add another two times the current program savings. The building sectors with the most remaining savings potential are "Manufacturing Plants, Warehouses, Labs", "Schools, Libraries, and Labs (non-manufacturing)" and "Stores and Restaurants." These priority building sectors primarily use a DBwDTs design process.

Within the SCE territory, customer participation rate in SBD as well as total program savings remained generally consistent from 2006 to 2010, but then decreased from 2011 to 2012. Overall, electric savings has the potential to add another five times the current program savings. The building sectors with the most remaining savings potential are "Stores and Restaurants" and "Schools, Libraries, and Labs (non-manufacturing)." These priority building sectors primarily use a DBwDTs design process.

Solutions on how to effectively market and outreach to each of these market sectors is provided in *Section 7.3-Barriers and Solutions to SBD Priority Buildings*.

6.2 Savings By Design Market and Economic Trends

Focusing on national economic trends in new construction and local population and employment trends in each of the IOUs, Navigant projects growth opportunities in each of the IOU territories.

Nationally construction spending is slowly growing. Census data shows private sector growth has outpaced cuts in public sector investments. The AIA indicates growth in both their Architectural Billings Index and their Consensus Construction Forecast Panel.

From April 2010 to July 2012 California's population grew 2.1 percent and California's Department of Finance predicts state population to increase 8.9 percent over ten years. From 2010 to 2020 SCE's service territory is predicted to grow 21.5 million, PG&E is predicted to grow 9.9 percent and SDG&E is predicted to grow 7 percent.

While population growth provides an indication of the overall numbers of people expected to reside in each utility service area, considering growth in employment by industry type allows for an understanding of what types of business spaces will need to be built. In PG&E's service area the industries with the largest growth rate from 2010 to 2020 are forecasted to be in professional and business services followed by information services, educational and health services, and construction. In SDG&E's service area the industries with the largest growth rate are forecasted to be in professional and business services, leisure and hospitality, and educational and health services. Over the same period in SCE's service area the industries with the largest growth rate are forecasted to be in educational and health services, leisure and hospitality, and professional and business services.

6.3 Factors Affecting Energy-Efficiency Decisions

Many elements influence whether a design team participates in SBD and how successful a design team is in achieving comprehensive savings. Generally speaking, most buildings are influenced to some degree by the items listed in Table 6-1.

Table 6-1: Drivers and Barriers to Energy Efficiency in California

Drivers	» Achieving a green or efficient certification and the associated positive marketing » The potential to receive incentives for both the owner and the design team » Saving on the lifecycle cost of ownership » Realizing the non-energy benefits of highly performing buildings
Barriers	» The cost of the energy efficient measure, developing an energy model and undertaking a more detailed design » The perceived need for short payback periods » The complexity of the program and the need for participant education of the process » The timing and speed of intervention with the design process » The willingness of the design team to collaborate with each other on an integrated design as well as be fully engaged in promoting and designing energy efficiency » Serving the needs of accelerated design processes such as Design/Build projects, small and medium projects or "non-standard" buildings » The ability to adjust the budget once financing is secured

When considering whether a new construction project is likely to be enrolled in SBD, the primary drivers are ownership type, occupancy type and building type. A SBD Program Manager who understands these influences can leverage existing drivers and minimize barriers. Leased spaces are motivated by occupancy and rental rates, so promoting tenant desires to occupy high-performing buildings will encourage participation. Marketing and outreach should be tailored to the audience. Public sector buildings respond better to life-cycle cost analysis, while the private sector tends to need benefits that are more immediate such as generous incentives and improved lighting performance from LED lighting.

Buildings are broadly designed with a DBB, a DBwDT or a DBwC design process. Each of these approaches has different influences and timelines. The SBD program works best with the DBB process.

When the design team is experienced with SBD, the program can work well with the DBwDT. To reach the full market potential, the SBD program should be flexible enough to influence efficiency regardless of the design process and minimize barriers for historically non-participant design team members.

Incentives are a strong influence for both design teams and building owners to participate in SBD. While all incentives currently offered are popular, the Whole Building and Design Team incentives are the most influential in driving participation. Measurement and Verification incentives are appreciated by strong proponents of energy efficiency, but have limited traction with others. Incentive suggestions include targeting historically hard to reach markets, providing a new incentive structure for ZNE buildings and providing incentives for behavior change measures.

The technical assistance of the SBD program is exhibiting best practices and is generally appreciated by building owners. SBD is attempting to reach design teams early in the process and facilitating kick-off meetings. There are multiple points of contact with the design team, using a variety of written and in-person methods. Modeling is used as a tool to proactively consider design enhancements and a comprehensive list of efficiency improvements are being offered. Navigant did not find evidence of mid-construction visits, where in-person inspections can drive higher levels of envelope sealing and insulation.

6.4 Non-Residential New Construction Trends

Surveying leading programs and national subject matter experts Navigant compiled new strategies that are being considered or implemented across North America. These suggestions and observations are offered to the IOUs for consideration.

New approaches to program design include designs intended to focus technical assistance where it can be most effective, and working beyond territorial boundaries. SBD should consider expanding their program offerings so that they can influence and enroll new construction projects that are medium to low complexity, but work with a limited design budget. One strategy to handle a larger diversity of buildings is to determine a design team's goals and appropriating technical support and incentive resources where they are needed most. Additionally, more programs are seeking to work across service territories to coordinate offerings and goals. There may be opportunities for California IOUs to work beyond state borders and coordinate with the Pacific Northwest states.

Public recognition such as design awards and enhanced incentives in new applications is one way that leading programs have further transformed their markets. SBD may consider providing new enhanced incentives for ZNE projects, or offering energy modeling incentives for projects that may not have the resources to do modeling without incentives. Additionally, increasing the public recognition of best-of-breed design and building practices will motivate the construction industry to further embrace high-performance buildings.

While SBD has already increased their efforts on outreach and education, these can be important tools in transforming a market. New trends for consideration include developing in-house design guides for medium complexity building or buildings using a Design/Build approach. The SBD program may investigate hosting a builder's conference that can focus on efficient design and building techniques. Additionally, dedicated Efficiency Account Managers and Efficiency Technology Leads can focus outreach and educational efforts to SBD's largest and most important customers.

Programs studied have run or are in the process of developing ZNE programs. One of the main themes that all the programs include is a relaxing of the ZNE requirement; instead encouraging a path towards ZNE. Achieving ZNE is more about the collective design process and efforts should be focused there rather than on individual efficiency technologies. While larger incentives may be required to increase participation, get a firm commitment upfront and hold the participants accountable. Education is an important component of encouraging ZNE buildings and providing successful case studies is helpful motivating the marketplace. Finally, SBD can play a pivotal role assisting with the marketing of ZNE buildings.

Appendix A. Literary Review

A.1 Energy Efficiency Best Practices

ARUP. *The Technical Feasibility of Zero Net Energy Buildings in California.* San Francisco, CA: ARUP, December 31, 2012, CALMAC Study ID: PGE0326.01. http://www.energydataweb.com/cpucFiles/pdaDocs/904/California_ZNE_Technical_Feasibility_Report_Final.pdf

This report discusses the overall feasibility of the Zero Net Energy (ZNE) goals for California's commercial building sector. Through exploration of the technical challenges, strategies for design and cost expectations, this report determines that ZNE buildings will be technically feasible for much of California's new construction market in 2020. The report also provides exemplar prototypes for many significant building sectors including medium office, large office, strip malls, secondary schools, large hotels, grocery store, sit-down restaurants, warehouses and colleges.

Schuetter, Scott, Scott Hackel and Saranya Gunasingh. *Searching for Savings Opportunities in Commercial and New Construction Programs.* Madison, WI: Energy Center of Wisconsin, July 31, 2013, Publication Number: ECW Report Number 267-1. http://www.ecw.org/ecwresults/267-1.pdf

Utility sponsored, energy efficiency, commercial new construction programs often use whole building energy modeling analysis to determine energy efficient choices during design. However, post-occupancy monitoring or analysis of a building to determine whether it performs as energy modeling predicted is still not standard practice. This report investigates what could be learned from post-occupancy monitoring of energy use and how that information could be leveraged to find additional savings.

This report outlines several improvements that can be made to both the building modeling process and the scope of what is included in commercial new construction energy efficiency programs to improve the accuracy of savings estimates and increase the energy savings achieved.

A.2 Project Delivery Methods

Rocky Mountain Institute. *RMI: Using Contracting to Improve Building Project Delivery and Achieve Sustainable Goals.* Boulder, CO: Rocky Mountain Institute, 2013. http://www.rmi.org/Knowledge-Center/Library/2013-15_IMFContractingRpt

This paper discusses the attributes of traditional project delivery that prohibit the achievement of aggressive sustainability goals. Solutions are presented in the form of adapting the contracting process to follow integrated project delivery guidelines. Through these small changes to the contracting process, large gains can be made towards meeting performance-based, aggressive sustainability goals.

A.3 Offices

American Council for an Energy-Efficient Economy. *Financing for Multi-Tenant Building Efficiency: Why this Market is Underserved and What Can be Done to Reach it.* Washington, DC: American Council for an Energy-Efficient Economy, August 2013. http://www.aceee.org/research-report/e13e

Split incentives remain a primary barrier to energy efficiency investments in leased space along with other barriers such as high upfront costs and aligning the installation of energy efficiency measures and payback with owner investment horizons and financial incentives. This report identifies the ownership models for owning and leasing commercial office buildings and the energy efficiency challenges associated with each model.

Financing mechanisms are identified and discussed in relation to their benefits and challenges. Each of these financing mechanisms is discussed in relation to the ownership models in an attempt to align best approaches for each model. Additionally, this report identifies opportunities to drive up demand for energy efficient projects within the commercial office market segment by addressing the inherent barriers.

California Sustainability Alliance. *Greening California's Leased Office Space: Challenges and Opportunities.* May 5, 2009. http://sustainca.org/sites/default/files/GreenLeases_report_050509.pdf

California's commercial office building sector remains a significant opportunity of untapped potential energy savings. However, greening this commercial office space brings with it a unique set of challenges including split incentives, the complexity of green lease negotiations and the lack of knowledge about green building principles within the leasing industry. In 2008 the California Sustainability Alliance developed a *Green Leasing Toolkit* and tested the toolkit with a portion of California's state agency leases managed by the Department of General Services. This report presents the findings of this process and provides recommendations for accelerating the greening of all of California's leased office space.

Rocky Mountain Institute and BOMA International. *Working Together for Sustainability: The RMI-BOMA Guide for Landlords and Tenants.* Snowmass, CO and Washington, DC: Rocky Mountain Institute and BOMA International, June 2012. http://www.rmi.org/Knowledge-Center/Library/2012-05_GuideForLandlordsTenants

This paper presents a strategy for dealing with the issue of "split incentives" which is encountered when both a landlord and tenant are involved in the energy efficiency discussion. The concern surrounds the fact that in most cases the landlord will make the capital investment to make energy efficiency improvements, while the tenant will reap the benefit of the transaction. Five actionable steps are outlined: make energy use and costs more transparent, engage building occupants in saving energy, incorporate energy efficiency in tenant fit-outs, plan ahead for deep energy retrofits, and structure agreements to benefit both parties.

Sator, Spencer. *"Managing Office Plug Loads." ESource Energy Managers' Quarterly*, June 2008. http://www.cityofpaloalto.org/civicax/filebank/documents/15887

The end-use with the greatest untapped potential for energy efficiency in the commercial building sector is that of plug loads. A plug load is defined as the efficiency of any electronic device plugged into a socket, and very little progress has been made into curbing the energy use of these devices. In fact office plug loads often account for one-fifth of an office energy bill, similar to that of heating, lighting or air conditioning. This report presents the average annual energy consumption of common contributors to plug loads and discusses strategies for addressing plug loads through policy, organizational and buying decisions, often at very low cost to the business.

A.4 Banks

Energy Trust of Oregon. *"Small Building, Big Savings."* [Case Study]. http://energytrust.org/library/case-studies/NBE_Rivermark_CaseStudy_FINAL_for_web.pdf

This case study of the Rivermark Community Credit Union illustrates a story of energy efficiency specifically focused on low cost energy savings, required by many public institutions. The Rivermark Credit Union worked with Oregon's Small Commercial Efficiency pilot, which focused on buildings up to 70,000 SF, to achieve a 21% reduction in electricity use, compared to a standard building of the same size. This project utilized Core Performance guidelines as energy modeling would have been cost prohibitive. With minimal up-front cost the bank realized large savings and provide benefit over many years.

A.5 Manufacturing

Peterson, Sharon and Barrow, Pam. *Climate and Energy Intensity Reduction: The Northwest Food Processors Challenge.* NEEA and Northwest Food Processors Association, November 2010. http://neea.org/docs/white-papers/climate-and-energy-intensity-reduction-the-northwest-food-processors-challenge.pdf?sfvrsn=6

The industrial sector has constantly been plagued by the fact that one-size-fits-all efficiency programs are just not practical. In 2008 NEEA began an executive-level collaboration with the Northwest Food Processors Association (NWFPA) with a goal to reduce member-wide intensity 25 percent in 10 years and 50 percent in 20 years. This paper summarizes the key findings and recommended steps for others as a result of this collaboration. While the results presented here have direct applicability to the industrial sector, they beg consideration for partnership with other industries to bring about greater efficiency savings than could be realized through traditional efficiency programs.

Energy Trust of Oregon. *"Investment in Efficiency Builds Competitive Edge."* [Case Study] http://energytrust.org/library/case-studies/PE_CS_FCCFurniture_1107.pdf

FCC Commercial Furniture builds furniture for large chain restaurants across the US. Since 2005 FCC has worked with the Energy Trust of Oregon on energy efficiency projects which included both production efficiency and high-efficiency lighting, trimming energy costs by $36,000

annually. This case study investigates the variety of energy efficiency projects completed by FCC, including replacement of their dust collection system, lighting upgrades, new vacuum pumps, the addition of a makeup air Variable Frequency Drive and a new compressed air system.

Energy Trust of Oregon. *"Geared for Energy Efficiency."* [Case Study] http://energytrust.org/library/case-studies/NBE_KingCycle_CaseStudy_FINAL_for_web.pdf

The design of the King Cycle Group's new 65,000 SF manufacturing facility demonstrates sustainable design can be cost effective for even small manufacturers. The new manufacturing space was built in a warehouse shell that had previously been used for storage. Instead of replacing all of the equipment, which was too cost prohibitive, King Cycles explore alternative options an installed a whole building water source heat pump which used recovered heat from the manufacturing equipment to warm the building and installed energy efficient lighting and air compressors. The company remains committed to energy efficiency and is even considering installing a 40,000 to 100,000 gallon underground water storage tank to balance the water loop's heating and cooling needs so the system could operate an entire day without running the boiler or chillers.

A.6 Warehouse

Energy Trust of Oregon. *"Food Distributor Develops a Taste for Energy-Efficient Lighting."* [Case Study] http://energytrust.org/library/case-studies/DPINorthwest_CaseStudy_IND_1309.pdf

In most cases lighting upgrades offer the greatest opportunity for energy efficiency savings in warehouses. Energy Trust of Oregon's case study of DPI Northwest illustrates one such story. DPI Northwest delivers specialty food items to grocery stores and restaurants throughout the Pacific Northwest and as such, half of their 250,000 SF warehouse is either refrigerated or cooled. However this space needs to be well lit for employee productivity and safety. DPI Northwest worked with ETO to replace existing metal halides with LEDs, which perform well in the refrigerated areas. The lighting improvement project has resulted in a 12% decrease per day in total energy consumption, which is significant considering half of the space is cooled. Additionally, the lighting upgrade has resulted in higher accuracy rates as well.

A.7 Public Buildings – Schools & Libraries

Energy Trust of Oregon. *"Energy-Saving Solutions Earn High Marks."* [Case Study] http://energytrust.org/library/case-studies/BE_CS_NWNWA_Schools.pdf\

This case study discusses a variety of energy efficiency projects supported by the Energy Trust of Oregon for both public and private schools in Oregon. These projects include measures as diverse as increasing insulation, upgrading HVAC systems and upgrading food service equipment.

National Renewable Energy Laboratory. *Building Energy-Efficient Schools in New Orleans Lessons Learned.* December 2011. Publication Number: DOE/GO-102011-3290. http://www.nrel.gov/docs/fy12osti/51639.pdf

After Hurricane Katrina, New Orleans was faced with the need to renovate and replace many of its existing school facilities. In the rebuilding effort a goal was set for new schools to strive toward 31.5 percent energy savings and 25 percent energy savings when renovated. This report summarizes the lessons learned through this process, focusing on five school projects (four new and one renovation) to illustrate the diverse energy saving opportunities available in school buildings.

Northeast Energy Efficiency Partnerships. *Greening the Public Sector, Maximizing Energy Efficiency.* October 2012. http://www.neep.org/Assets/uploads/files/public-policy/high-performance-buildings/HPB%20Policy%20Report_FINAL.pdf

This report reviews policies within the northeast that mandate the construction of high-performance state-funded buildings and makes recommendations on policy changes to maximize savings in the public sector. Alongside the policy recommendations, this report highlights high-performance projects in the northeast in market areas such as education and libraries.

A.8 Restaurants

Efficiency Partnership. *Boosting Restaurant Profits with Energy Efficiency, A Guide for Restaurant Owners and Managers.* San Francisco, CA: Efficiency Partnership, August 2006. http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/foodservices/Boosting_Restaurant_Profits_with_Energy_Efficiency.pdf

Restaurants rank as some of the most energy-intensive commercial spaces in California. This report provides recommendations for energy efficiency in restaurants including both buying new cooking equipment and tips related to water efficiency, refrigeration efficiency, HVAC efficiency and lighting efficiency. While restaurant energy efficiency is often viewed as having large associated upfront costs, this report provides some no-nonsense, low cost solutions that can be embraced by any restaurant owner.

A.9 Retail Buildings

Pacific Northwest National Laboratory. *Advanced Energy Retrofit Guides: Retail Buildings.* September 2011. Publication Number: PNNL-20814. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-20814.pdf

The Advanced Energy Retrofit Guides (AERGs) put out by the US Department of Energy were created to help decision makers plan and implement energy efficiency projects. One of the biggest challenges in current literature is providing reliable and actionable costs associated with energy savings. The AERGs attempt to address this concern by providing methods for calculating the cost-effectiveness of energy efficient measures. This guide specifically focused on retail buildings, targets measures for HVAC systems and lighting, as these segments make up the biggest components of energy use for most retail buildings.

Appendix B. Construction Monitor Methodology and Data

Construction Monitor is an online building permit database the compiles building permit and valuation data for construction projects across the country. Though Construction Monitor's main purpose is to provide leads to contractors, developers and suppliers in the industry, Navigant saw the opportunity to use the information to determine the key players in the California construction market. Through collaborative communication with the Construction Monitor team, Navigant submitted a data request for the top 15 companies in each of the main categories of general contractors, architects/designers, engineers, and applicants/agents for counties within the IOU's territories. For each category and county, Navigant received the following information by month from Jan 2002 to present:

1. Total number of permits
2. Total valuation ($)
3. Commercial construction building type
4. Square footage information (if available)

From this information, Navigant was able to gain a general understanding of the market actors and their share of the new construction market over the last 10 years. To pinpoint the current key market actors, Navigant analyzed the permit and valuation totals by year for the last 7-5 years. By comparing individual company permit and valuation numbers against the totals for all activity in each county annually, Navigant was able to paint a picture of construction activity within different industry groups.

To gain additional clarity, Navigant grouped the valuation totals into four tier levels. By splitting up the valuation into tiered values, Navigant was able to distinguish key market actors for a variety of valuation classes. The distribution of active companies within each tier gave shape to the market by indicating which companies were pulling permits for the largest projects over the last five years within each tier grouping; therefore Navigant could identify the primary market actors within each size grouping. Using the county information, Navigant created IOU specific distributions which give a basic perspective of the main market actors in each IOU territories. This data shows a general view of the new construction market and was used as a starting point to understand the key players by IOU territory.

Table B-1: SDG&E Top 20 Permit Pullers, 2008-2012

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Smith Consulting Arch	Designers	10	10	15	25	17	77
Barbara Harris Permitting	Applicants/Agents	7	4	26	27	2	66
Ware & Malcomb Architects	Designers	16	7	3	6	3	35
Sunshine Permit Srv	Applicants/Agents	12	4	2	10	1	29
Bycor General Contractors	Contractors	7	8	8	11	7	41
Ken Smith Arch	Designers	9	5	5	3	2	24

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Johnson & Jennings	Contractors	3	8	5	7	4	27
Permits In Motion	Applicants/Agents	7	1	6	2		16
Mansour Arch	Designers	6	5	2	2		15
Permit Solutions	Applicants/Agents	4	2	10	13		29
Burger Const & Prprty Srv	Contractors	2	5	6	6	5	24
Lusardi Const	Contractors	5	4	2	5	3	19
DesignCorp	Designers		12	3	5		20
Hamann Const	Contractors	6	3	2	3	3	17
Permit Us	Applicants/Agents	2		12	6	1	21
Roel Const	Contractors	5	7	3	4		19
Nadel Architects	Designers	5		2	6	1	14
Studio C Architects	Designers	7	4	2	1	2	16
Booth & Suarez	Designers	3	6		7	1	17
Pacific Building Group	Contractors	5	3	4	4	4	20

Table B-2: SDG&E Top 20 Valuation Projects, 2008-2012

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Bycor General Contractors	Contractors	$10,856,145	$6,623,785	$34,964,140	$21,382,717	$30,081,573	$103,908,360
DPR Construction, Inc.	Contractors	$5,238,469	$6,897,465	$19,329,917	$39,288,200	$15,461,343	$86,215,394
Molasky Group	Contractors					$77,001,194	$77,001,194
Lusardi Const	Contractors	$15,419,325	$9,797,903	$1,809,838	$33,248,279	$5,992,317	$66,267,662
Sundt	Contractors	$49,771,514	$7,260,714				$57,032,228
Hamann Const	Contractors	$18,129,400	$12,127,787	$8,477,278	$3,272,323	$12,842,250	$54,849,038
CW Driver Inc.	Contractors	$9,744,361		$419,802	$3,999,512	$36,481,079	50,644,754
Delawie Wilkes Rodrigues	Designers	$14,859,867		$150,000	$16,382,123	$17,004,642	$48,396,632

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Ariel Suites LP	Contractors					$42,397,587	$42,397,587
Burger Const & Prprty Srv	Contractors	$3,787,214	$4,447,076	$8,960,485	$11,967,815	$8,592,685	$37,755,275
Reno Contr	Contractors	$12,532,303	$11,593,187	$7,333,596	$4,767,052		$36,226,138
Turner Construction Company	Contractors	$27,621,268		$3,089,931		$5,133,520	$35,844,719
Smith Consulting Arch	Designers	$13,087,140	$4,789,510	$3,804,062	$7,782,867	$6,188,445	$35,652,024
Roel Const	Contractors	$10,425,838	$10,823,969	$7,818,908	$6,377,540		$35,446,255
Good & Roberts	Contractors	$26,007,344	$3,362,302		$468,438	$3,765,435	$33,603,519
Johnson & Jennings	Contractors	$2,562,311	$7,934,388	$5,332,666	$10,562,411	$6,765,990	$33,157,766
Garden Communities	Contractors					$32,128,352	$32,128,352
Hensel Phelps Construction	Contractors	$29,600,201					$29,600,201
Swinerton Builders	Contractors	$1,093,880		$9,168,649	$4,876,832	$13,906,082	$29,045,443
Wermers Multi Fmly Corp	Contractors	$10,000,000		$18,385,627			$28,385,627

Table B-3: PG&E Top 20 Permit Pullers, 2008-2012

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
GCI Inc.	Contractor	4	34	86	109	101	334
Devcon Construction, Inc.	Contractor	21	65	81	76	87	331
Hathaway-Dinwiddie Const.	Contractor	2	27	99	104	76	308
BCCI Construction Company	Contractor	11	72	79	81	33	277
Sacramento County	Contractor	37	41	39	36	52	204
Todd Dimartino	Contractor	4	34	55	83	1	177
Chevron	Contractor	1	19	20	67	58	165

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Peacock Construction, Inc.	Contractor	1	34	26	38	51	149
XL Construction Corp	Contractor	3	11	28	32	48	123
Swinerton & Walberg Co	Contractor	3	14	33	44	24	118
Skyline Construction Inc.	Contractor	4	3	5	22	80	112
Engel & Co	Contractor	33	26	46	3	4	112
McLarney Const.	Contractor	3	11	25	42	25	105
Swinerton Builders	Contractor	2	20	21	40	20	103
Kaiser Foundation Health Construction Services	Contractor	9	27	22	23	23	103
DPR Construction, Inc.	Contractor	5	15	25	36	22	102
Dome Construction Corpora	Contractor	9	12	16	34	28	98
CSI Contractors Inc.	Contractor	31	36	9	5	14	96
Cannon Associates	Engineer	2	0	0	54	38	94
Plains Exploration & Production	Applicant/Agent	0	0	2	48	41	92

Table B-4: PG&E Top 20 Valuation Projects, 2008-2012

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Sunpower Corp Systems	Contractor	$3,076,094	$22,015,205	$4,226,792	$1,044,350,669	$513,642,021	$1,587,310,781
Engeo Engineering	Engineer	$	$	$	$1,048,479,877	$497,060,608	$1,545,540,485
Devcon Constructio n, Inc.	Contractor	$40,164,504	$84,871,684	$94,155,198	$132,060,381	$848,575,567	$1,199,827,334
North Coast Eng	Engineer	$28,298	$	$	$989,102,246	$24,236,117	$1,013,366,661
Twisselman Gypsum	Applicant/A gent	$	$	$	$638,005,855	$28,681	$638,034,535
Carl & Martha Twiselman	Applicant/A gent	$	$	$	$592,014,136	$5,286,779	$597,300,916
Charles Pankow Builders	Contractor	$6,498,382	$	$	$164,747,487	$173,694,600	$344,940,468

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Riverside Engineering Group	Engineer	$	$	$	$	$305,925,755	$305,925,755
Andy Shrek	Contractor	$120,000	$	$	$	$283,502,212	$283,622,212
Novo Construction, Inc.	Contractor	$4,813,332	$18,441,280	$50,440,583	$94,012,052	$107,851,966	$275,559,213
Hathaway-Dinwiddie Const	Contractor	$170,000	$49,912,649	$48,679,870	$110,688,499	$58,348,461	$267,799,478
Turner Construction Company	Contractor	$4,221,162	$21,418,439	$62,724,155	$72,957,004	$60,256,195	$221,576,956
DPR Construction, Inc.	Contractor	$14,586,833	$25,530,761	$78,606,405	$ 54,841,896	$29,846,992	$203,412,887
Kevin Bosch	Contractor	$	$ -	$ -	$ -	$192,131,811	$192,131,811
San Jose Construction	Contractor	$13,821,595	$17,719,718	$20,328,457	$68,626,589	$69,328,835	$189,825,194
Avalon Bay Communities Inc.	Contractor	$	$ -	$1,350,000	$84,965,000	$84,965,000	$171,280,000
Bechtel Corp	Contractor	$	$ -	$	$76,125,648	$94,161,191	$170,286,839
BCCI Construction Company	Contractor	$11,830,057	$29,588,166	$43,962,471	$54,460,071	$21,548,443	$161,389,208
XL Construction Corp	Contractor	$ 9,023,061	$ 27,078,837	$19,440,887	$38,102,182	$64,923,279	$158,568,245
Blattner Energy Inc.	Contractor	$ -	$ -	$ -	$148,610,302	$9,060,709	$157,671,011

Table B-5: SCE Top 20 Permit Pullers, 2008-2012

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
MJY Group Inc.	Applicant/Agent	0	2	23	124	60	208
Casco Contr Inc.	Contractor	21	33	34	77	28	193
KPRS Const Services Inc.	Contractor	22	30	76	44	17	189
Ware & Malcomb Architects	Architect/Designer	70	25	30	18	19	161
LPA Inc.	Applicant/Agent	1	16	45	56	40	158

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
David Simpson Const Co Inc.	Contractor	20	14	22	64	35	156
Gensler	Architect/Designer	60	41	12	15	4	132
Turelk Inc.	Contractor	17	18	10	41	21	107
Kings County	Contractor	20	23	24	24	13	103
H Hendy Assoc	Applicant/Agent	0	13	19	34	32	98
DC Expediting	Applicant/Agent	36	5	29	19	5	96
SAA Interiors & Architects	Architect/Designer	17	11	27	34	5	95
Howard Building Corp	Contractor	9	8	25	21	16	78
Structural Concepts Engineering	Engineer	12	14	14	15	16	71
H Hendy Assoc	Architect/Designer	39	19	4	4	3	69
Engel & Co	Contractor	19	15	27	1	3	65
Interior Architects	Architect/Designer	9	2	2	48	4	65
JAM Dairy Construction Inc.	Contractor	29	18	3	5	7	62
Gensler	Applicant/Agent	7	19	33	1	0	60
DBAC Inc.	Contractor	16	12	10	6	15	59

Table B-6: SCE Top 20 Valuation Projects, 2008-2012

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
Walsh Austin Joint Venture	Contractor	$ -	$ -	$319,869,593	$ -	$13,742,644	$333,612,237
Hathaway-Dinwiddie Const	Contractor	$32,901,250	$48,082,373	$61,596,116	$140,571,717	$4,890,621	$288,042,077
Oltmans Const	Contractor	$106,071,932	$14,338,372	$38,939,074	$37,579,821	$71,003,448	$267,932,647
Fentress Architects	Architect/Designer	$ -	$ -	$ 191,834,597	$ -	$ -	$191,834,597
Fullmer Const	Contractor	$27,142,594	$27,291,360	$43,630,250	$51,647,029	$27,111,829	$176,823,062
Hensel Phelps Construction	Contractor	$ -	$ -	$112,710,400	$61,390,032	$ -	$174,100,431

Company Name	Type	2008	2009	2010	2011	2012	Grand Total
McCarthy Building Companies Inc.	Contractor	$27,505,911	$62,909,393	$4,239,928	$18,569,050	$46,686,248	$159,910,530
KPRS Const Services Inc.	Contractor	$25,189,024	$47,909,001	$20,890,597	$25,217,084	$18,136,716	$137,342,423
Gensler	Architect/Designer	$57,598,124	$36,213,081	$7,275,432	$17,406,415	$4,208,360	$122,701,413
Matt Construction Corporation	Contractor	$28,292,468	$2,800,022	$11,492,907	$35,894,075	$42,909,355	$121,388,828
Driver SPG	Contractor	$44,768,431	$4,038,112	$52,221,911	$8,635,582	$3,593,550	$113,257,587
Western National Contr	Contractor	$59,528,883	$ -	$ -	$45,563,753	$ -	$105,092,636
Webcor Builders	Contractor	$98,765,865	$ -	$1,467,186	$1,467,186	$ -	$101,700,238
Millie & Severson Inc.	Contractor	$34,100,548	$302,660	$1,423,547	$17,657,507	$39,921,278	$93,405,539
H Hendy Assoc	Contractor	$ -	$ -	$ -	$89,536,862	$ -	$89,536,862
RGA Architects	Architect/ Designer	$63,923,229	$3,940,638	$11,243,885	$2,150,603	$7,054,792	$88,313,147
Ware & Malcomb Architects	Architect/ Designer	$32,996,401	$5,762,496	$24,496,729	$11,697,395	$12,569,468	$87,522,489
LPA Inc.	Applicant/ Agent	$117,231	$9,061,157	$35,939,188	$24,917,172	$17,247,981	$87,282,728
JD Diffenbaugh	Contractor	$32,103,318	$1,207,462	$53,570,047	$ -	$ -	$86,880,828
Bomel Const Co Inc.	Contractor	$41,117,181	$12,768,370	$3,087,211	$29,156,090	$ -	$86,128,853

In addition to industry professional group information, Construction Monitor provided permit and valuation information for all building types in the State of California. Table B-7 indicates that renovation projects were the highest grossing project type for the last five years. The other top grossing building types include offices, mixed use, industrial/warehouses and retail. In Table B-8, renovation projects are shown as having the greatest number of permits pulled over the last five years. Figure B-1shows that the percentage new construction spending dedicated to renovation projects peaked in 2009 and has slowly

decreased in subsequent years. Nevertheless, remodeled projects remain an important and significant part of the new construction market.

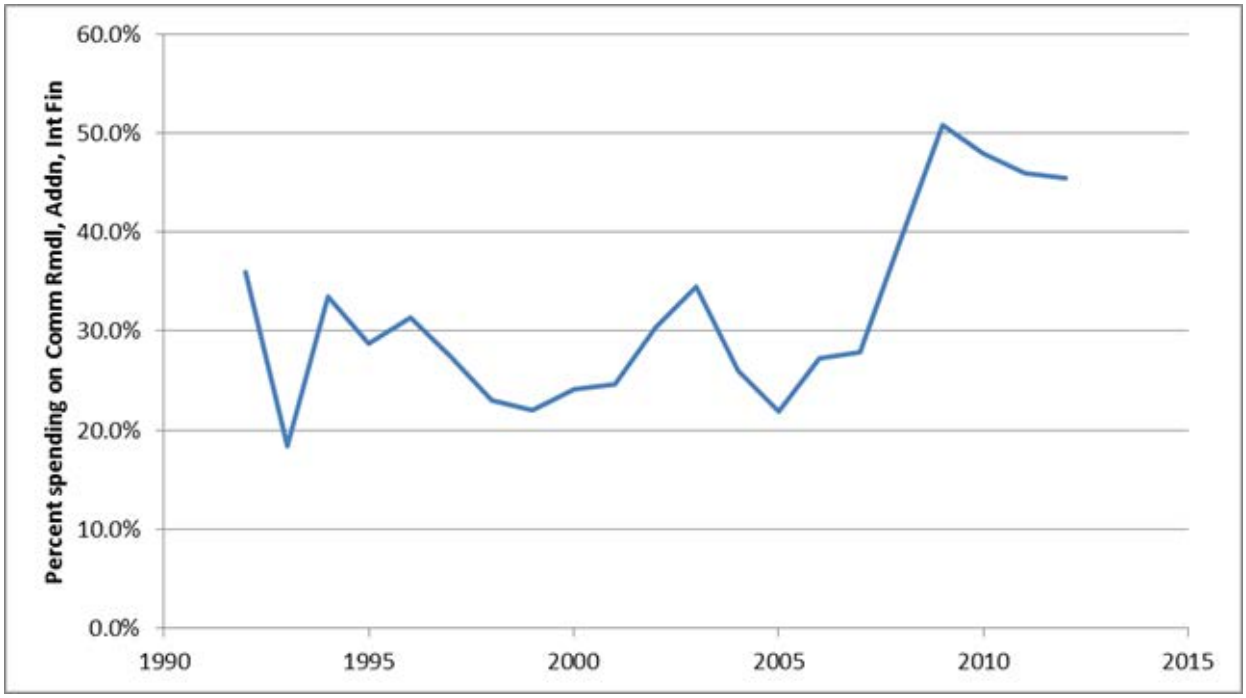
Table B-7: California Top 5 Building Types, by Total Value, 2008-2012

Building Types	2008	2009	2010	2011	2012	Grand Total
Commercial Remodel, Addition, Int Fin	$4,374,323,074	$4,522,737,228	$5,258,438,434	$7,196,678,830	$5,750,952,073	$27,103,129,639
Offices/Banks/R&D/ Professional	$946,429,842	$750,600,172	$568,372,847	$679,447,857	$597,470,704	$3,542,321,422
Mixed Use	$436,199,577	$167,131,944	$693,153,064	$1,259,994,559	$884,304,770	$3,440,783,914
Industrial/Manufacturing, Warehouse-Shops, Transportation	$1,088,473,376	$462,956,228	$437,513,021	$578,500,903	$655,784,279	$3,223,227,807
Retail/Wholesale/Dining/Personal Care	$1,000,886,810	$498,066,156	$469,808,882	$545,722,992	$429,259,105	$2,943,743,945

Table B-8: California Top 10 Building Type, by Number of Permits Pulled, 2008-2012

Building Types	2008	2009	2010	2011	2012	Grand Total
Comm Rmdl, Addn, Int Fin	21,921	25,544	26,686	29,915	22,838	188,032
Comm Structures Other Than Buildings	2,775	1,805	1,998	1,580	1,043	20,868
Agricultural Buildings & Sheds	1,376	985	946	1,016	641	12,550
Indus-Manuf, Whse-Shops, Transp	962	511	464	485	486	11,263
Retail/Whsl/Dining/Personal Care	1,385	932	663	731	635	11,135
Offices/Banks/R&D/Professional	1,013	678	526	539	447	9,733
Other Non-Residential Buildings	716	758	801	582	550	7,582
Reroof Commercial		391	2,020	2,300	1,510	6,221
Demolition (Commercial)	672	851	1,494	1,736	1,072	5,890
Utilities (gas elect wtr swr)	451	643	878	345	207	5,249

Figure B-1: Percent Spending on Commercial Remodel Projects in California



Appendix C. Economic Analysis, National and IOU Service Territory Trends

This appendix discusses likely market and economic trends expected to impact nonresidential new construction over the next several years, especially within the PG&E, SCE and SDG&E service areas. These macro statistics and projections are presented for consideration for future SBD Program planning, as they shed light on which market levers might be best used to achieve Program success and ultimately help reach California's energy efficiency goals. Specific objectives of this trend research include examining construction rate and building type trends expected during the next three to five years and identifying uncertainties and influences that might affect the market.

In keeping with the scope of this study, this section updates market and economic trend data presented in the *2011 SCE SBD Study* and expands upon it to examine the same types of information for PG&E's and SDG&E's territories.

C.1 Approach

Navigant relied primarily on literature and secondary studies to provide information on market and economic trends. Sources included industry publications and journals, construction industry forecasts, economic forecasts, government statistics and forecasts, and general press sources. These sources informed the following qualitative and quantitative information about the impacts of the recession and what levels and types of building and development activities are most likely to occur over the next three to five years.

C.2 Findings

Our review of macro trends, like that conducted in the *2011 SCE SBD Study*, focused on major economic indicators in recent history and projections for the next several years.

Recession Effects and Rebound Expectations

The effects of the recent economic collapse continue to be felt globally nationally, and throughout California[29]. Continuing unemployment and tight credit markets have kept the demand for new construction, residential and non-residential, significantly reduced. The Associated General Contractors of America (AGC) reports that six years of a construction downturn cost more than 2 million jobs and turned a $1.2 trillion-a-year industry into an $800 billion-a-year one.[30] Additionally, while some feel that that the billions of dollars spent through the American Recovery and Reinvestment Act of 2009 (ARRA) helped to keep the recession from becoming much worse, private sector investment in new capital construction projects is not flowing back into the market as was hoped. While national economic recovery began in mid-2009, the economy still exhibited subpar growth in 2012. Recent "Fiscal Cliff" concerns have fueled anxiety (or, at a minimum, caution) in both the public and private sectors, causing

[29] As dated by the National Bureau of Economic Research (NBER), making it the longest recession since World War II. http://www.nber.org/cycles/sept2010.html

[30] Associated General Contractors of America, *Tentative Signs of Recovery: The 2013 Construction Hiring and Business Outlook*. (January 2013), 2. http://www.agc.org/galleries/news/2013_Construction_Hiring_and_Business_Outlook_Report.pdf

a general slowing of the recovery as both consumer and business sentiment indices dropped. The U.S. construction market now faces both depressed private investment and proposed federal government spending cuts. Uncertainty about potential sequestration has reportedly had a direct impact on design and construction activity, causing significant delays or cancellations of active projects.

While the past several years have seen marked drops in new nonresidential new construction starts, as in any economy, declines in one area typically mean increased opportunities in others. For the nonresidential construction industry one of these was in the area of renovations, the share of which grew during the downturn.

As discussed in the *2011 SCE SBD Study*, the economic downturn has created an inventory of surplus buildings in some building categories (e.g., retail, office and warehouse 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 undertake renovations. In some cases these renovations may repurpose facilities for use by other sectors, such as for healthcare and educational purposes.

Another bright spot seems to be in the area of "green" construction and energy efficient projects. While sustainable building has experienced some setbacks along with the construction industry as a whole, reducing energy use and seeking some sort of green certification are among the primary objectives of most construction projects, even renovation projects.[31] The trend is towards more owners wanting LEED-certified buildings, especially owners of apartment complexes, office buildings, public buildings, schools and hospitals. Because of the increasing demand or renters and occupants for green facilities, the costs for these facilities are decreasing and we are seeing a closing gap between the cost of standard buildings and efficient buildings.

The 2012 Johnson Controls' Institute for Building Efficiency Energy Efficiency Indicator (EEI) survey[32] found that interest in energy efficiency continues to grow among decision-makers responsible for energy investments and activities. More specifically, the study showed that:

- Interest in energy efficiency jumped 20 percent from 2011 to 2012. Sixty-six percent of U.S. and Canadian executives reported in 2011 that energy management was very or extremely important to their organizations and in 2012 that number jumped to 86 percent.
- Seventy-four percent of U.S./Canadian respondents had invested in energy efficiency in the past year, more than in any other region.
- Forty-six percent of business executives planned to increase energy efficient-related spending in the next 12 months while 39 percent expected investment to stay the same.

[31] As reported in the 2012 Johnson Controls' Institute for Building Efficiency Energy Efficiency Indicator (EEI) survey.

[32] The EEI survey reveals the energy priorities, practices, investment plans and barriers facing building decision-makers responsible for energy investments and activities in their companies. The 2012 global survey included nearly 3,500 facility managers and building executives and owners. More on the survey can be found at www.InstituteBE.com.

» Thirty-nine percent of respondents planned to pursue green certification of new buildings (compared to 35 percent in 2011) and 35 percent of existing buildings (compared to 27 percent in 2011); 60 percent already had at least one green certified building.

The 2012 Johnson Controls survey also found that finances remained the major barrier to pursuing energy efficiency for U.S./Canada respondents. The top barrier was a lack of funding to pay for improvements (37 percent), followed by insufficient payback/ROI (21 percent). Competition for other capital investments and insufficient internal capital budget constrained investment in efficiency. Tax credits and financial incentives top the list of energy policies that would have the greatest impact on improving energy efficiency in buildings, with 42 percent of executives saying these measures would help overcome barriers that are currently acing.

According to McGraw-Hill estimates,[33] green is expected to represent 44 percent of all commercial and institutional construction in 2012, growing to 55 percent by 2016. The value of total green building, non-residential and residential, grew from $10 billion in 2005 to $78 billion in 2011, and is projected to rise to between $98 billion and $106 billion in 2013. By 2016, this number is expected to reach $204 billion to $248 billion.

McGraw-Hill also reports that 45 percent of architectural, engineering and construction firms expect to have green jobs by 2014, in line with the green building share of 48 to 50 percent by 2015. The company also found that that 71 percent of industry hiring decision-makers feel that being green-certified increases competitiveness.[34]

However, in contrast, it should be noted that a late 2012 survey conducted by AGC found 60 percent of firms (primarily general contractors) expect demand for green projects to stagnate in 2013, while another five percent expect to see fewer green projects this year.[35] (These numbers are a bit more optimistic for California, specifically, with 54 percent anticipating green project demand to remain the same, and three percent expecting a decline. Thirty-eight percent of California respondents projected an increase in green projects in 2013.)

In addition, AGC notes that declining demand for public structures is likely to negatively impact demand for green projects, as governments have tended to aggressively pursue efficient facilities. The President's renewed commitment to energy efficiency may help ameliorate this situation. In his February 12, 2013 State of the Union address, President Obama expressed a new goal for America to cut residential and commercial energy waste in half during the next twenty years. To help achieve this goal

[33] McGraw-Hill Construction, *2013 Dodge Construction Green Outlook* (November 2012).
[34] McGraw-Hill Construction, "Greenbuild: Growing Green Building Market Supports 661,000 Green Jobs in the U.S.— a Third of the Design and Construction Workforce— According to New McGraw-Hill Construction Study," (October 4, 2011). http://www.construction.com/about-us/press/mcgraw-hill-construction-study-green-jobs.asp
[35] Associated General Contractors of America, *Tentative Signs of Recovery*, 7. Survey respondents included over 1,300 firms from D.C. and every state except for Delaware — primarily from among the 20,000 general contractor or specialty subcontractor members of the Associated General Contractors of America. The survey was fielded November 2012 – December 2012.

the President pledged federal support to those states with the best ideas to create jobs and lower energy bills by constructing more efficient buildings.[36]

Economic Indicators and the Building Market

The general consensus among industry experts and economists is that signs of a general market improvement have begun to emerge, albeit more slowly and fainter than most would prefer. Construction markets are expected to face a long and slow recovery. The available indicators support this assessment.

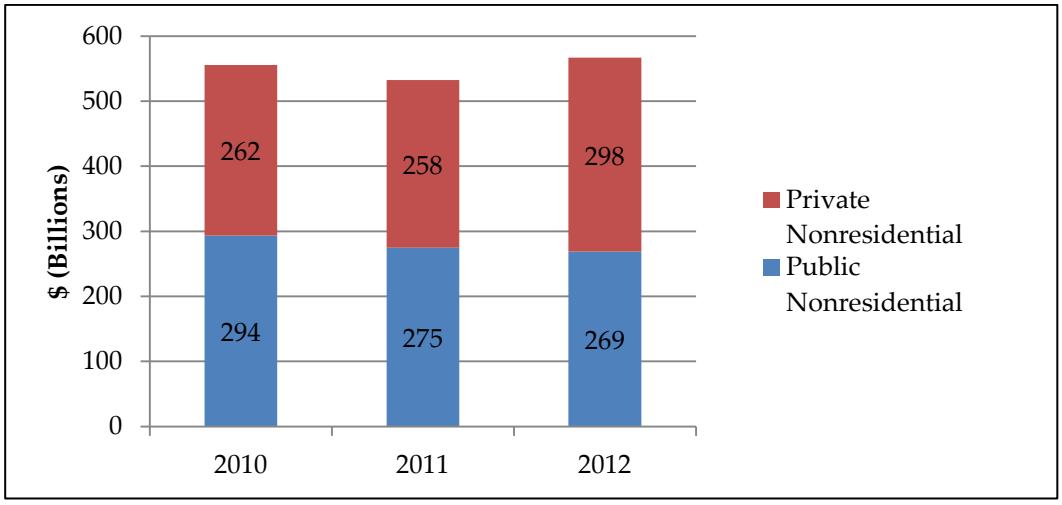
Typically, economic recovery begins with a stock market rebound, followed by the beginning of gross domestic product (GDP) recovery, and then by payroll employment increases. Finally, nonresidential construction starts begin to increase.[37] This cycle of economic recovery usually takes place within approximately seven quarters or about two years. Currently, GDP, personal income and jobs are all slowly growing, but there are some significant risks to recovery, both in the U.S. and abroad, including large jumps in taxes; sequestration and federal spending cuts; spikes in oil prices; and deepening slumps in foreign economies (and possible debt default and abandonment of the euro).

While U.S. GDP growth has greatly accelerated since the end of 2008, it is still lower than the long-term average of 6.71 percent. Similarly, although the U.S. has seen recent increases in employment (up 4.8 million jobs since the low in February 2010) they are not considered large enough to return employment to pre-recession levels. Gary Burtless of the Brookings Institute anticipates that at the current pace, full employment will not be achieved until the end of 2016.[38]

While in 2011 national nonresidential construction spending dipped a bit as compared to 2010, 2012 showed a small improvement overall, as shown in Figure C-1. It should be noted that private spending in nonresidential construction increased in each of the three years from 2010 through 2012 even as public spending was reduced.

[36] Barak Obama, State of the Union Address, February 12, 2013. http://www.whitehouse.gov/state-of-the-union-2013
[37] Kermit Baker, Chief Economist, American Institute of Architects. *2010 Market Insights Webcast Series: Construction Outlook: Ready for a Rebound* (originally presented May 4, 2010).
[38] Gary Burtless, "Slow but Steady: Job Market Improves in December," Brookings on Job Numbers blog (January 4, 2013). http://www.brookings.edu/blogs/jobs/posts/2013/01/04-jobs-burtless

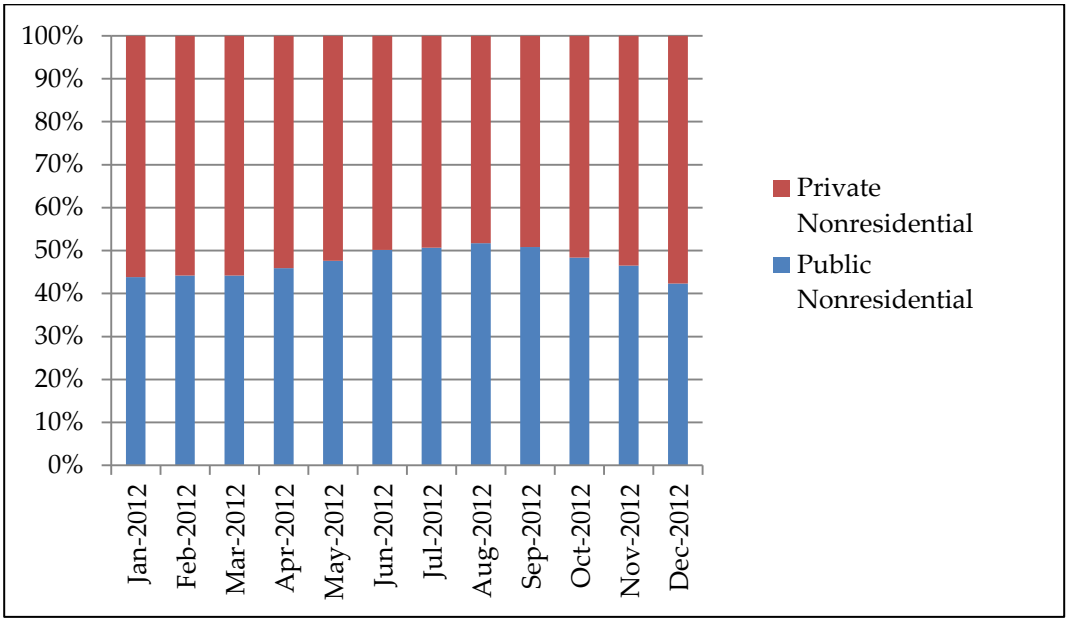
Figure C-1: U.S. Construction Spending, Nonresidential Public (v) Private, 2010 – 2012



Construction spending is total, not just spending on buildings. Not seasonally adjusted.
Source: U.S. Census Bureau http://www.census.gov/econ/currentdata/, Accessed 2/4/13

In 2012, private spending outpaced public spending in all months except July and August, as illustrated in Figure C-2.

Figure C-2: U.S. Construction Spending: Nonresidential, Public (v) Private, 2012



Construction spending is total, not just spending on buildings. Not Seasonally Adjusted.
Source: U.S. Census Bureau http://www.census.gov/econ/currentdata/, Accessed 2/4/13

Future Projections

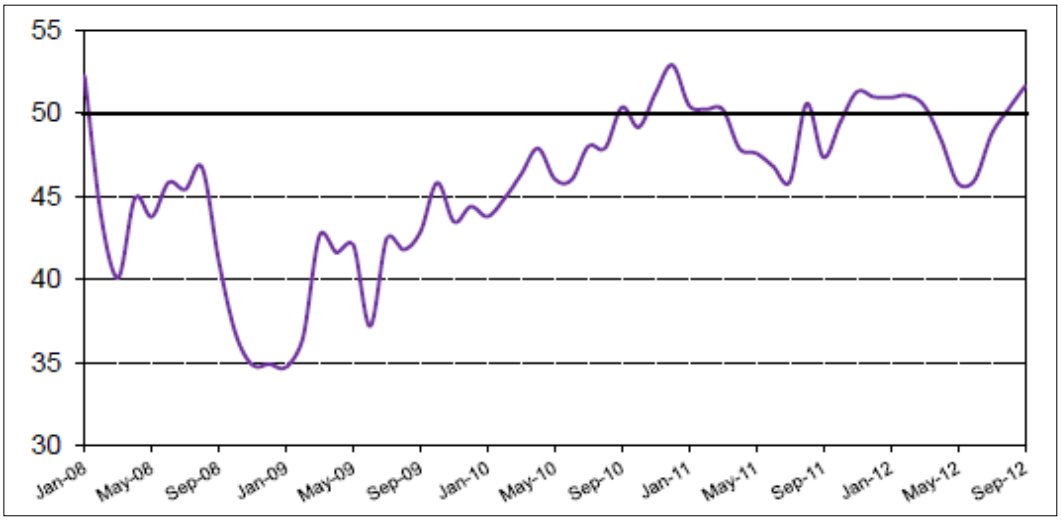
As we now look to what the future might hold, we consider the following projections and predictions for the building market from key study sources and economic indicators.

National Projections – Overall

The AIA produces two reports that help to project construction market futures: the Architecture Billing Index (ABI) and the Consensus Construction Forecast Panel. The 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. Any number below 50 indicates falling demand (50 indicates no change and above 50 increased demand). The ABI leads nonresidential construction activity by approximately nine to twelve months.

The AIA recently reported that the 2012 ABI showed its strongest numbers since 2007. According to the AIA, "while national ABI numbers were mixed in 2011—suggesting an uneven performance for construction in 2012—they were more uniformly positive in 2012. Eight of the 12 months of 2012 showed positive national ABI readings, including the final five months of the year. The ABI readings in the fourth quarter of 2012 were the strongest quarter since the downturn began in early 2008, suggesting that construction activity should begin to accelerate significantly in the first half of 2013."[39] Figure C-3 shows the 2008-2012 ABI.

Figure C-3: AIA Architectural Billings Index, 2008 - 2012



Source: AIA Architecture Billings Index as cited by Kermit Baker, Chief Economist, American Institute of Architects, in 2012 Economic Webcast: Post-Election Construction: Where Are We Heading? (originally presented November 8, 2012).

The ABI does not however indicate regional differences. At the end of 2012 business conditions were improving at firms in all regions except the West, which continued to struggle to rebound from almost

[39]Jennifer Riskus, "Final ABI for 2012 Caps Strongest Year Since 2007: More than a quarter of firms also report increases in speculative projects," *AIArchitect* 20 (January 25, 2013). http://www.aia.org/practicing/AIAB097350

half a decade of declining billings. The West was also the only region to register a decline (of seven percent) in construction starts (as compared to the national increase of six percent). AGC's 2012 survey reports similar findings, stating that contractors working in the Midwest, Southwest and Northeast appear significantly more optimistic about the year than do their counterparts working in the West and the South.

AIA's Consensus Construction Forecast Panel, which is conducted twice a year and includes projections of the nation's leading construction forecasters (including McGraw-Hill Construction, HIS-Global Insight, Moody's Economy.com, FMI, Reed's Construction Data, Associated Builders and Contractors, and Wells Fargo Securities), is consistent with information derived from the ABI.[40] Nonresidential construction activity is projected to see "healthy if unspectacular" gains in 2013 and 2014,[41] although a number of Consensus forecasters feel that real recovery will not begin to be seen until at least 2015.

National Projections by Sector

The Consensus Panel projects that the construction of commercial facilities is expected to lead the coming upturn for nonresidential building, with spending gains of almost eight percent in 2013 and nearly 11 percent in 2014. Hotel construction tops this sector with significant growth expected each year. Industrial construction spending is projected to nearly match the overall nonresidential building totals, although will not show the exceptional 20 percent growth it exhibited in 2012. Institutional construction activity will likely lag behind, although still show 1.2 percent and nearly 5 percent increases in 2013 and 2014, respectively. Healthcare is expected to lead the institutional sector in 2013 with an expected 4.4 percent bump, while amusement/recreation takes the top institutional spot in 2014 with 5.5 percent growth. Consensus forecasters expect spending for nonresidential structures to increase 5 percent, to about $315 billion in 2013 and an additional 7.2 percent, or $340 billion for 2014. However, this still falls below the $377 billion average in nonresidential construction spending seen over the past decade.

C.3 Population Trends

Recent U.S. Census figures point to a modest revival in national growth, with a 0.75 percent uptick for the year ending July 2012, as well as increases in international immigration and interstate migration (including a slight renewal in moves to the Sun Belt, the area most hard hit by the recession and housing market downturns of the past five years). The Brookings Institute series on *The State of Metropolitan America*, reports that "the nation appears to be rising back from the demographic dead, albeit slowly. The nadir was in 2010-2011 when the U.S. residential population grew by a mere 0.73 percent, the lowest rate, other than in wartime, since 1937. It reflected a long stretch of national economic malaise and its

[40] The AIA Consensus Forecast is computed as an average of the forecasts provided by the panelists that submit forecasts for each of the included building categories. There are no standard definitions of some nonresidential building categories, so panelists may define a given category somewhat differently. Panelists may choose to forecast only a portion of a category (e.g., public buildings but not private buildings); these partial forecasts are treated like any other forecasts in computing the consensus.

[41] Kermit Baker, "Steady Increase in U.S. Construction Activity Projected Through 2014: Commercial buildings expected to set pace with double-digit gains in spending next year," *AIArchitect* 20 (January 25, 2013). http://www.aia.org/practicing/AIAB097351

demographic consequences, including reduced immigration, declines in the number of births, and the lowest domestic migration levels since the end of World War II."[42]

California Overview

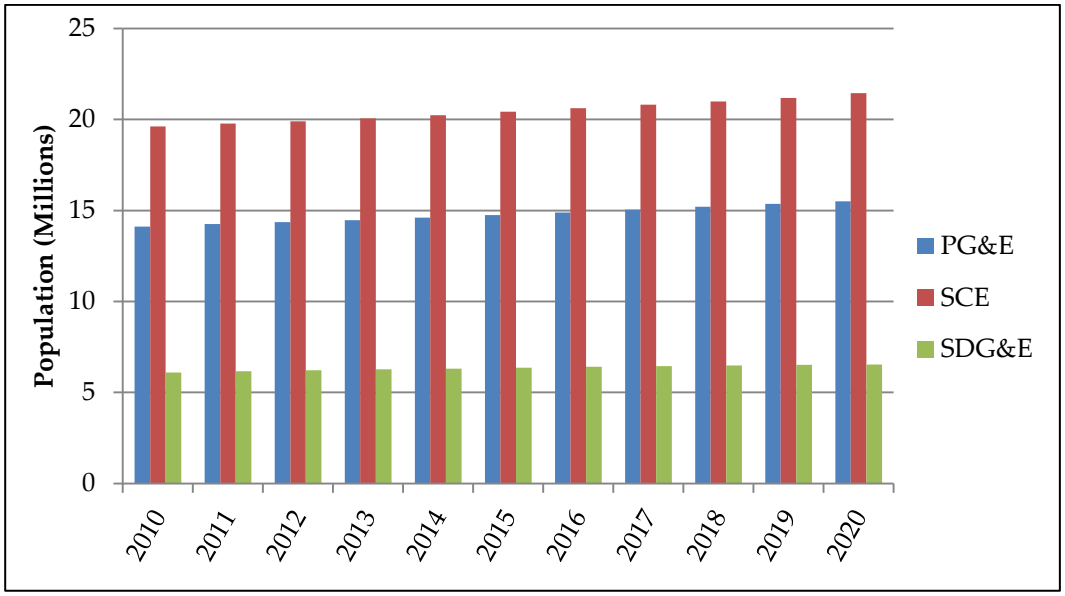
From April 2010 to July 2012 California's population grew 2.1 percent as compared to U.S. growth of 1.7 percent for the same period.[43] Looking forward to 2020, according to the State of California Department of Finance, California's population will grow to nearly 40.7 million, gaining more than 3.3 million people, up 8.9 percent from its 2010 population (but still well short of pre-recession projections). While foreign migration remains strong, domestic migration continues to be depressed. Southern California will lead the state's growth, with Riverside County expected to have the greatest numerical increase (largely attributed to migration from other parts of California, namely the Los Angeles Basin). The state anticipates significant population growth in coastal counties in Southern California, as well as in the Central Valley and parts of greater Sacramento and the Bay Area. However, none of the largest percentage gains will be along the coast. Rural California counties will tend to have an increasingly aging population and tend to grow at a slower pace than the rest of the state.[44] Figure C-4 indicates the populations of the IOU service territories by year from 2010 to 2020. While the largest population will remain in SCE's area (with a total projected population of almost 21.5 million by 2020), PG&E's area population will experience the largest percentage change, growing by 9.9 percent between 2010 and 2020. SDG&E's service area will experience 7 percent growth in the same decade.

[42] William Frey, "A Modest Population Bounce Back for the Sun Belt and the Nation," *State of Metropolitan America* 60 (December 21, 2012). http://www.brookings.edu/research/opinions/2012/12/21-census-population-migration-data-frey

[43] http://quickfacts.census.gov/qfd/states/06000.html

[44] *State of California, Department of Finance, Report P-2: State and County Population Projections by Race/Ethnicity and 5-Year Age Groups, 2010-2060 (*Sacramento, California: January 2013). http://www.dof.ca.gov/research/demographic/reports/projections/P-2/

Figure C-4: Population by California IOU Service Area, 2010 – 2020



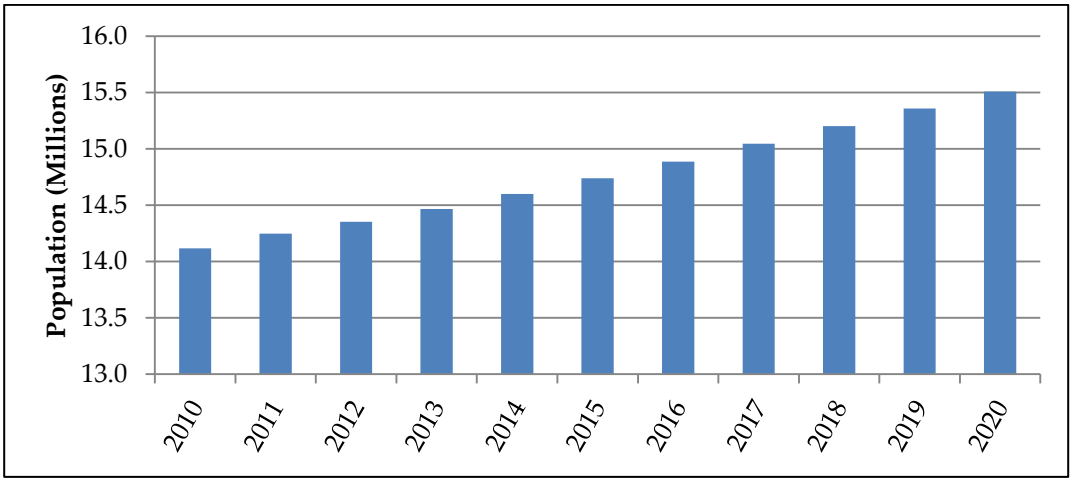
Sources: U.S. Census Bureau and State of California Department of Finance. Historical data end in 2010. Note that population figures are for entire counties included in each service area, even if multiple utilities serve a single county.

PG&E Service Area

In the 43 counties within PG&E's service area, the population is projected to grow 10.9 percent between 2010 and 2020, as indicated in Figure C-5. Figure C-6 illustrates that the counties projected to experience the largest growth during this 10-year time period are all in the Central Valley and include (in descending order) Kern (25.9 percent), Madera (22.7 percent), San Joaquin (18.3 percent), Merced (17.8 percent) and Yuba (17.1 percent). Three counties are expected to decrease in population, including Sierra (-6.4 percent), and to a lesser degree, Marin (-0.4 percent) and Alpine (-0.2 percent). Counties including larger metropolitan areas should exhibit modest growth, with San Francisco increasing 5.9 percent and Santa Clara County growing 6.1 percent.

Focusing on the nearer-term period of 2013 to 2016, the entire service area population is estimated to increase 2.9 percent. By county, the rankings remain similar, with several Central Valley counties showing relatively strong growth, led by Kern (8.6 percent). While Sierra (-0.9 percent) and Marin (-.5 percent) are anticipated to lose population in this shorter timeframe, Alpine exhibits growth (3.2 percent). San Francisco and Santa Clara counties each are expected to increase 1.8 percent.

Figure C-5: Population in the PG&E Service Area, 2010 – 2020



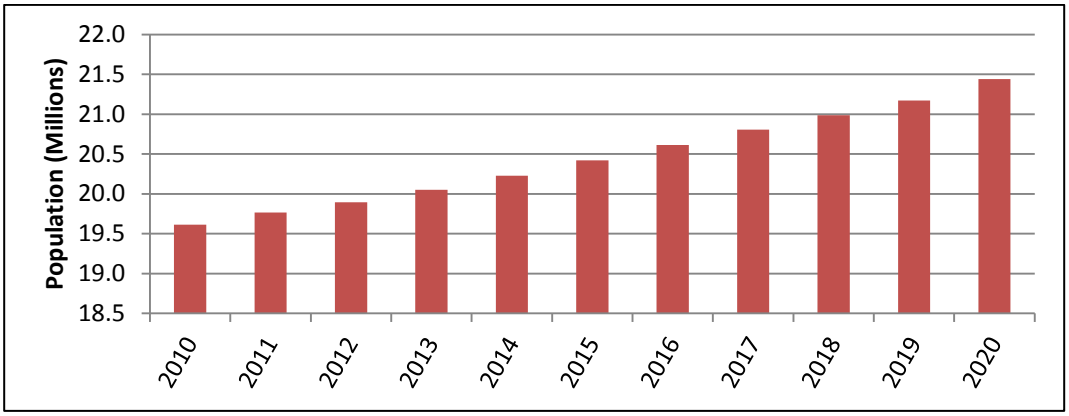
Sources: U.S. Census Bureau and State of California Department of Finance. Historical data end in 2010. Note that population figures are for entire counties included in each service area, even if multiple utilities serve a single county.

SCE Service Area

In the 10 counties included within the SCE territory, the population is projected to grow 9.3 percent between 2010 and 2020, to a combined population of over 1.8 million, as shown in Figure C-7. In this same timeframe, all counties should increase, as seen in Figure C-8, with Kern expected to show the highest growth rate at 25.9 percent, followed by Tulare (19.1 percent), Riverside (18.4 percent) and San Bernardino (11.7 percent). Inyo (4.3 percent), Ventura (5.4 percent) and Mono (5.9 percent) are estimated to show the least amount of growth. Los Angeles (6.3 percent), Santa Barbara (6.2 percent) and Orange (6.0 percent) counties are both expected to show modest growth. Inland areas are expected to outpace coastal areas during this next decade.

If we focus on the period of 2013 to 2016, these rankings remain essentially the same, with the exceptions of Mono, which exhibits 3.1 percent growth in this shorter timeframe and Ventura (2.1 percent), placing them both above the slower growing Los Angeles (1.7 percent), Santa Barbara (2.0 percent) and Orange (2.0 percent). Kern still tops the list with an expected increase of 8.6 percent and Inyo remains the slowest growing, at 1.0 percent.

Figure C-6: Population in the SCE Service Area, 2010 – 2020



Sources: U.S. Census Bureau and State of California Department of Finance. Historical data end in 2010. Note that population figures are for entire counties included in each service area, even if multiple utilities serve a single county.

SDG&E Service Area

In the two counties included within SDG&E's service area, the population is projected to grow 7.0 percent between 2010 and 2020 to reach a total of over 6.5 million, as indicated in Figure C-7. San Diego County will grow by 7.7 percent and Orange County will increase 6.2 percent. Between 2013 and 2016, these counties combined should grow 2.3 percent, with San Diego County (2.5 percent) outpacing Orange County (2.0 percent) in this shorter timeframe, as well.

Figure C-7: Population in the SDG&E Service Area, 2010 – 2020

Sources: U.S. Census Bureau and State of California Department of Finance. Historical data end in 2010. Note that population figures are for entire counties included in each service area, even if multiple utilities serve a single county.

C.4 Industry and Employment Data

Population growth is directly linked to employment trends, and the growth in employment by industry type effects the types of buildings built. In this section we discuss employment trends nationally, statewide and for the services areas of PG&E, SCE and SDG&E.

National Overview

The U.S. 2012 year-end non-farm payroll employment numbers show that the professional and business services sector accounted for 26 percent of all job gains in 2012, bringing it back to its pre-recession level. The education and health services sector also experienced strong growth, accounting for 25 percent of total employment growth in 2012. Wholesale and retail trade exhibited approximately the same rate of increase as that of overall employment growth, as did manufacturing (due, in no small part, to the reviving auto industry). However, as manufacturing experienced much larger losses in the recession as compared with other industries, it now accounts for a significantly smaller share of all jobs (8.9 percent in December 2012).

Government and construction sectors have not fared as well. Government employment continued to dwindle, although at a slower rate than in recent past. The construction industry saw small payroll gains during 2012, adding about 2,000 jobs per month. Year-over-year construction employment increased in 24 states plus D.C., decreased in 24 states and held steady in Vermont and West Virginia. The national unemployment rate was 7.8 percent in December 2012, down from the 8.5 percent posted in December 2011.

California Overview

According to the California EDD, nonfarm payroll employment rate for the State of California increased year-over-year in December 2012 by 1.6 percent, while the unemployment rate decreased from 11.2 percent in December 2011 to 9.8 percent in December 2012. In 2012 nonfarm payrolls in California grew in seven sectors: information (4.7 percent); construction (4.4 percent); leisure and hospitality (3.9 percent); educational and health services (2.9 percent); financial activities (2.4 percent); professional and business services (2.3 percent); and trade, transportation, and utilities (1.8 percent). Private sector employment in California, which excludes government, increased by 257,400 jobs (2.2 percent).[45]

As noted, growth in the nonresidential building sector is linked to growth in industry payrolls. To assess what types of buildings will likely be built, it is important to look at where growth is projected to occur. According to California's EDD, the largest growth rate from 2010 to 2020, is forecast to be in the following industries: construction (expected to increase 26.2 percent), educational and health services (25.6 percent), leisure and hospitality (25.5 percent) and professional and business services (23.3 percent). Federal government jobs are estimated to decrease 13.7 percent.

It should be noted that for the service area discussions that follow, data, in a number of cases, was only available for the years 2008 and 2018, as opposed to 2010 and 2020. However, as it is expected that the variance will not greatly impact the totals, we uniformly discuss information in terms of the years 2010 and 2020. Tables include notes as to which areas reflect 2008 and 2018 data.

[45] State of California Employment Development Department, *California Labor Market Review* (December 2012). http://www.calmis.ca.gov/file/lfmonth/calmr.pdf

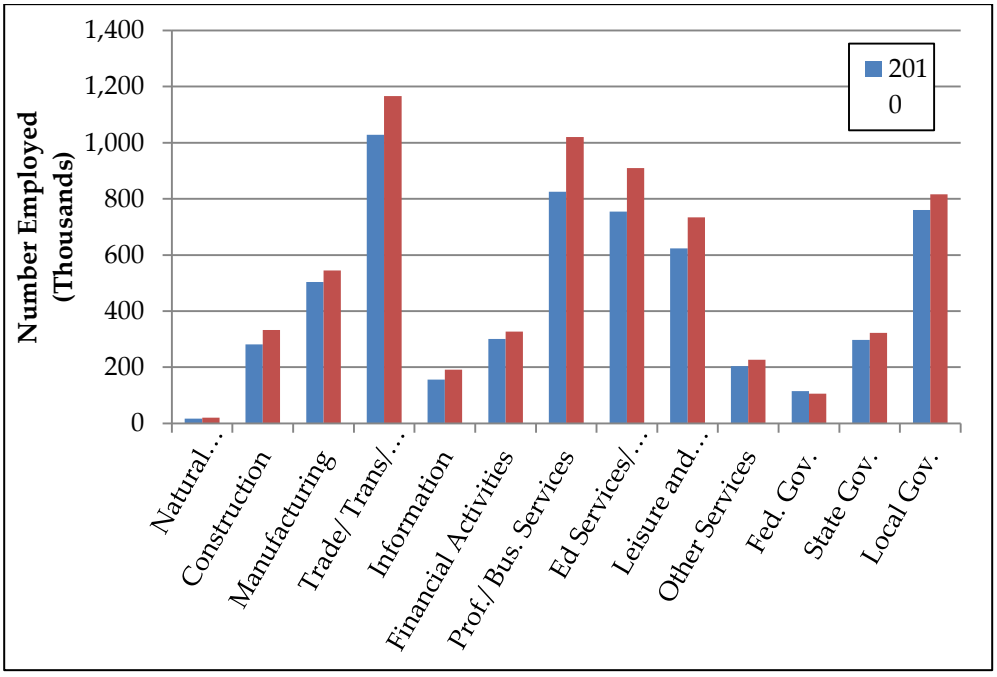
PG&E Service Area

According to California's EDD and as shown in Figure C-8 and Figure C-9, industries with the largest share of employment in the PG&E's service area in 2010 were trade, transportation, and utilities (1,028,420 jobs or 17.5 percent), professional and business services (825,290 jobs or 14.1 percent), and local government (760,270 jobs or 13 percent). The educational and health services industry is almost as large as local government with 755,080 jobs (12.9 percent).

Figure C-10 indicate that in 2020 the largest share of employment is projected to be in the same four industries that hold that title today, although educational and health services (910,050 jobs or 13.5 percent) will overtake local government (816,660 jobs or 12.2 percent). Trade, transportation, and utilities will retain the top spot with 17.4 percent of jobs, followed by professional and business services at 15.2 percent.

The largest growth rate from 2010 to 2020, as illustrated in Figure C-11, is forecast to be in the following industries: professional and business services (increasing 23.7 percent), followed by information (up 22.2 percent), educational and health services (20.5 percent), and construction (18.1 percent). Federal government jobs are estimated to decrease 8.1 percent, losing 9,400 jobs.

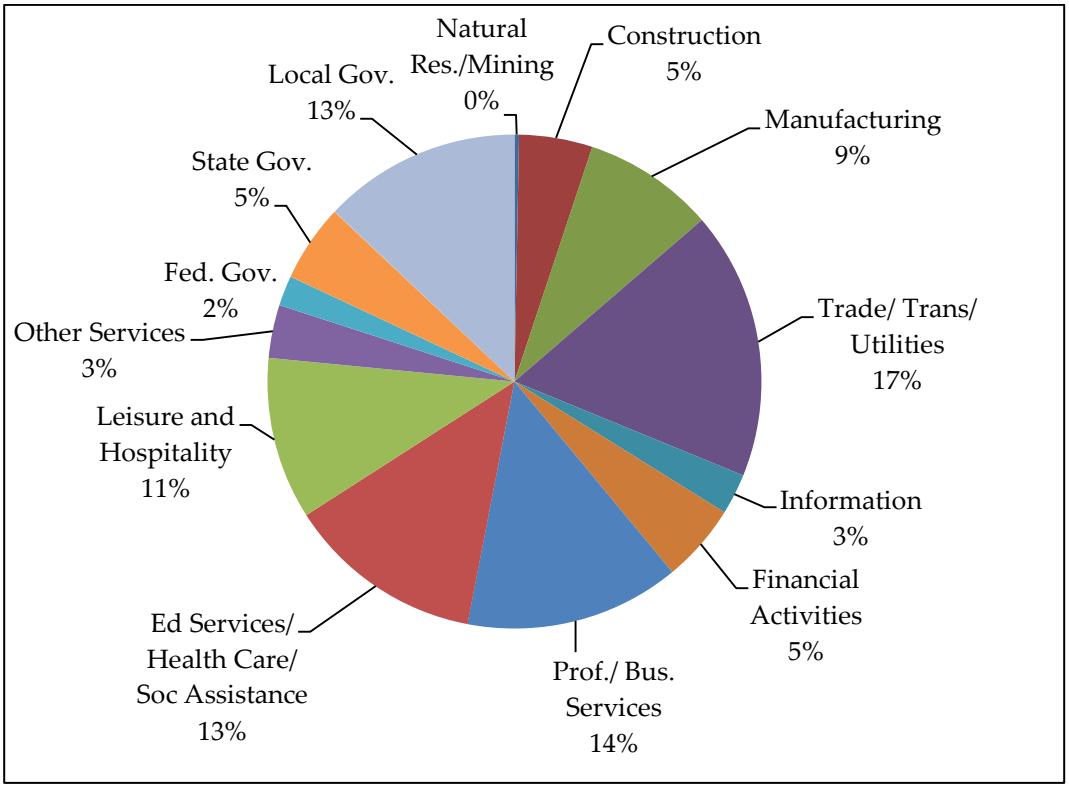
Figure C-8: Employment in PG&E Service Area, by Industry, 2010 and 2020[46]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

[46] Data for Alpine, Amador, Calaveras, Mariposa, Tuolumne, Butte, Colusa, Glenn, Tehama, Fresno, Del Norte, Humboldt, Lake, Mendocino, Kings, Lassen, Modoc, Nevada, Plumas, Sierra, Siskiyou, Trinity, Madera, Merced, Monterey , Napa ,San Joaquin , San Luis Obispo, Santa Cruz, Shasta , Solano, Sonoma , Stanislaus , Sutter and Yuba Counties are for 2008 and 2018 rather than 2010 and 2020.

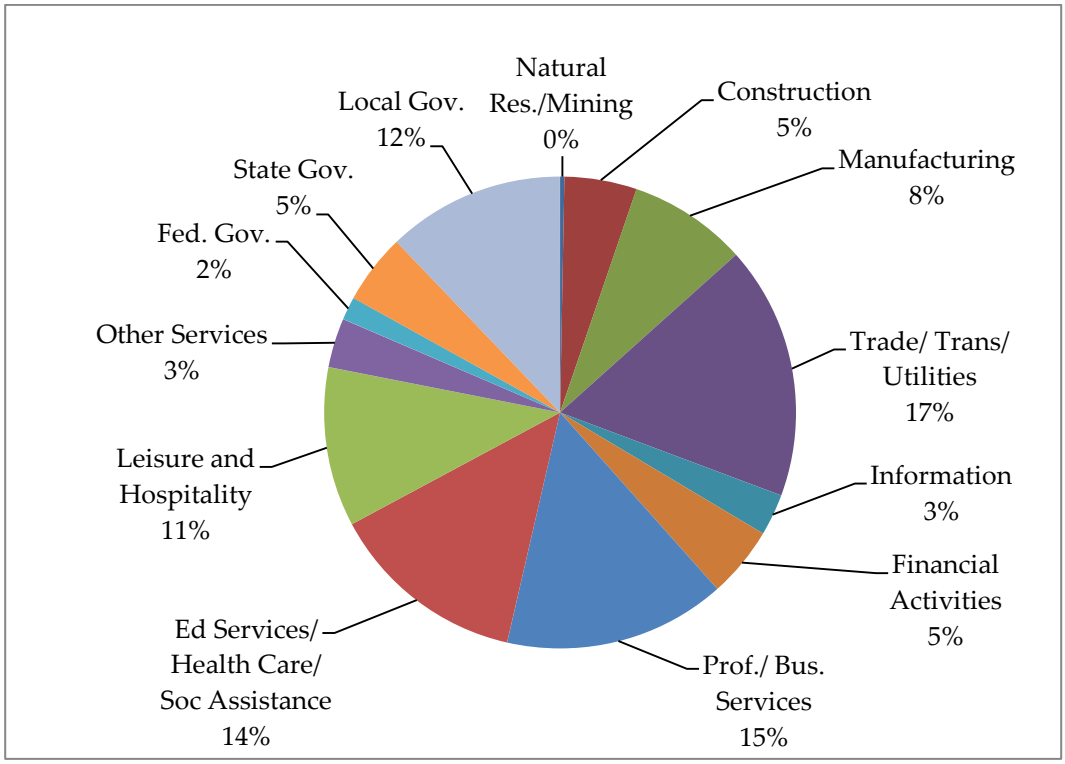
Figure C-9: Employment in the PG&E Service Area, by Industry, 2010[47]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

[47] Data for Alpine, Amador, Calaveras, Mariposa, Tuolumne, Butte, Colusa, Glenn, Tehama, Fresno, Del Norte, Humboldt, Lake, Mendocino, Kings, Lassen, Modoc, Nevada, Plumas, Sierra, Siskiyou, Trinity, Madera, Merced, Monterey , Napa ,San Joaquin , San Luis Obispo, Santa Cruz, Shasta , Solano, Sonoma , Stanislaus , Sutter and Yuba Counties are for 2008 rather than 2010.

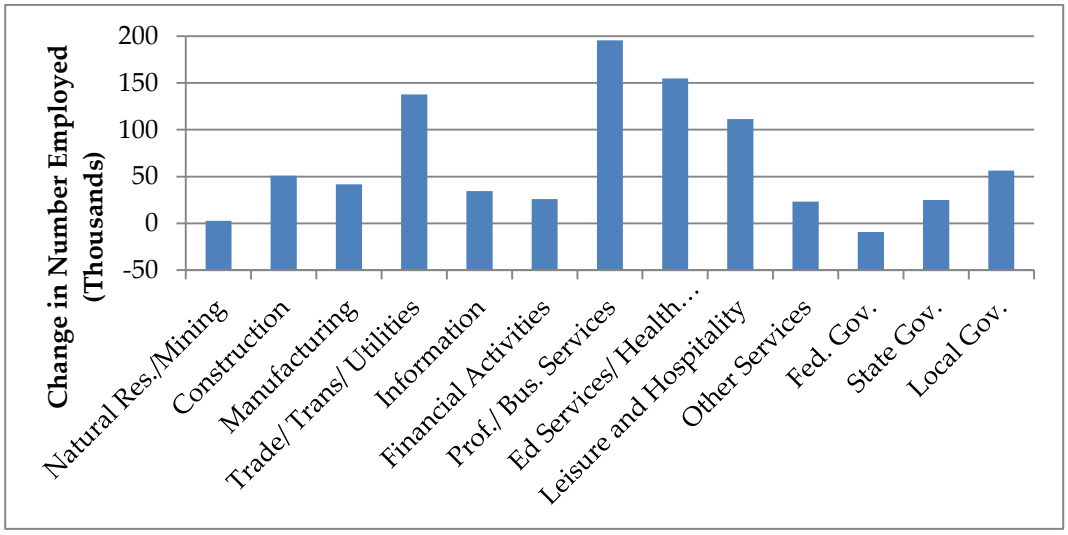
Figure C-10: Employment in the PG&E Service Area, by Industry, 2020[48]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

[48] Available data for Alpine, Amador, Calaveras, Mariposa, Tuolumne, Butte, Colusa, Glenn, Tehama, Fresno, Del Norte, Humboldt, Lake, Mendocino, Kings, Lassen, Modoc, Nevada, Plumas, Sierra, Siskiyou, Trinity, Madera, Merced, Monterey , Napa ,San Joaquin , San Luis Obispo, Santa Cruz, Shasta , Solano, Sonoma , Stanislaus , Sutter and Yuba Counties are for 2018 rather than 2020.

Figure C-11: Change in Employment in PG&E Service Area, by Industry, 2010 through 2020[49]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

SCE Service Area

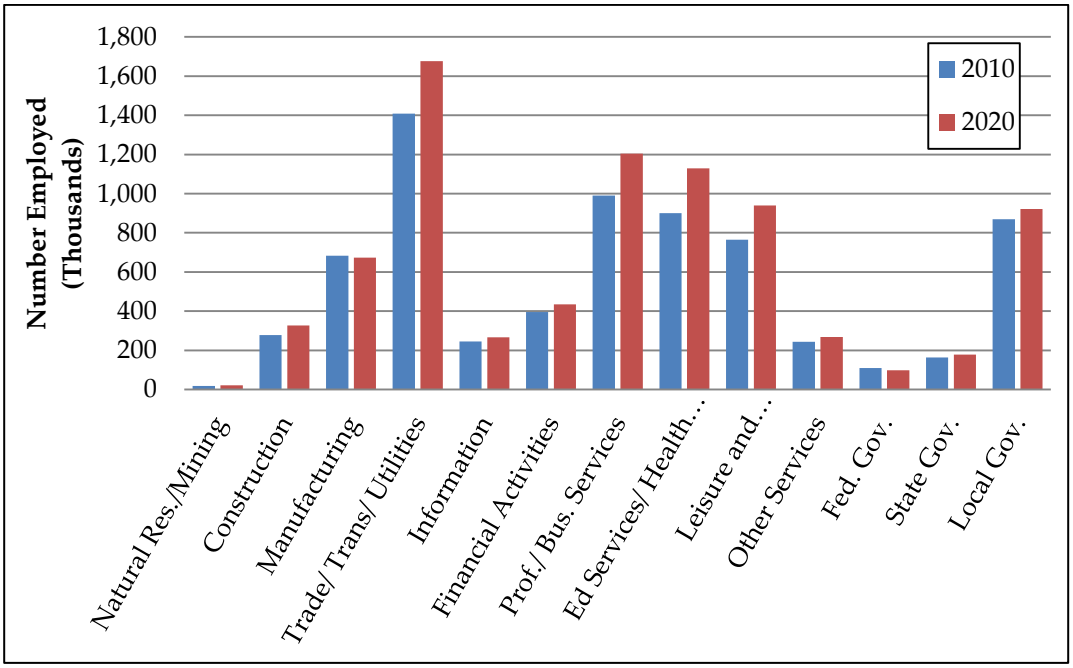
According to California's EDD and as shown in Figure C-12 and Figure C-13 industries with the largest share of employment in the SCE's service area in 2010 were trade, transportation, and utilities (1,408,220 jobs or 19.9 percent), professional and business services (989,600 jobs or 14.0 percent), and educational and health services (900,780 jobs or 12.7 percent). Although government spending has been cut, local government retains a large portion of employment, with 870,140 jobs (12.3 percent).

Figure C-14 indicate that in 2020 the largest share of employment is projected to be in the those same three industries that hold the top positions today, with trade, transportation, and utilities having 20.6 percent of jobs, professional and business services with 14.8 percent, and educational and health services with 13.9 percent. As in PG&E's service area, while local government will retain a large segment of jobs (11.3 percent), leisure and hospitality will squeak past it in 2020 with 11.5 percent of the total.

The largest growth rate from 2010 to 2020, as illustrated in Figure C-15, is forecasted to be in the following industries: educational and health services (25.3 percent), leisure and hospitality (22.7 percent) and professional and business services (21.7 percent). Federal government and manufacturing jobs are both expected to decrease, dropping 11.3 percent and 1.3 percent, respectively.

[49] Available data for Alpine, Amador, Calaveras, Mariposa, Tuolumne, Butte, Colusa, Glenn, Tehama, Fresno, Del Norte, Humboldt, Lake, Mendocino, Kings, Lassen, Modoc, Nevada, Plumas, Sierra, Siskiyou, Trinity, Madera, Merced, Monterey , Napa ,San Joaquin , San Luis Obispo, Santa Cruz, Shasta , Solano, Sonoma , Stanislaus , Sutter and Yuba Counties are for 2008 and 2018 rather than 2010 and 2020.

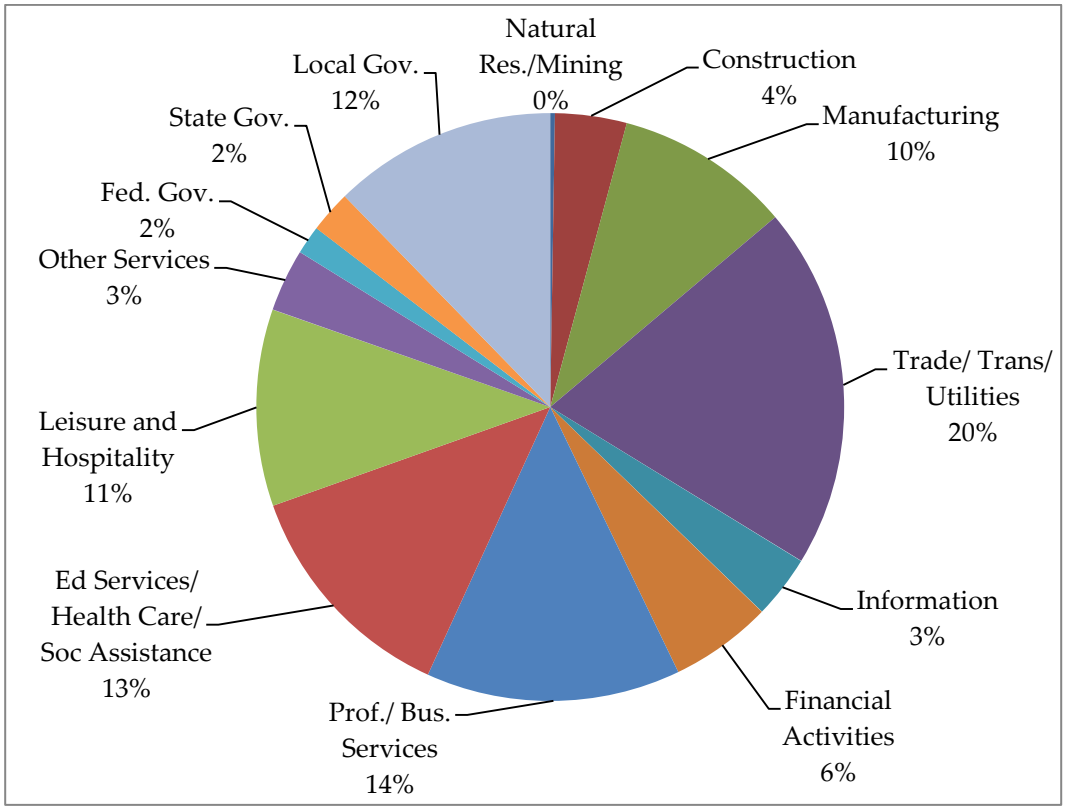
Figure C-12: Employment in the SCE Service Area, by Industry, 2010 and 2020[50]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

[50] Available data for Alpine, Inyo, Mono and Ventura Counties are for 2008 and 2018 rather than 2010 and 2020.

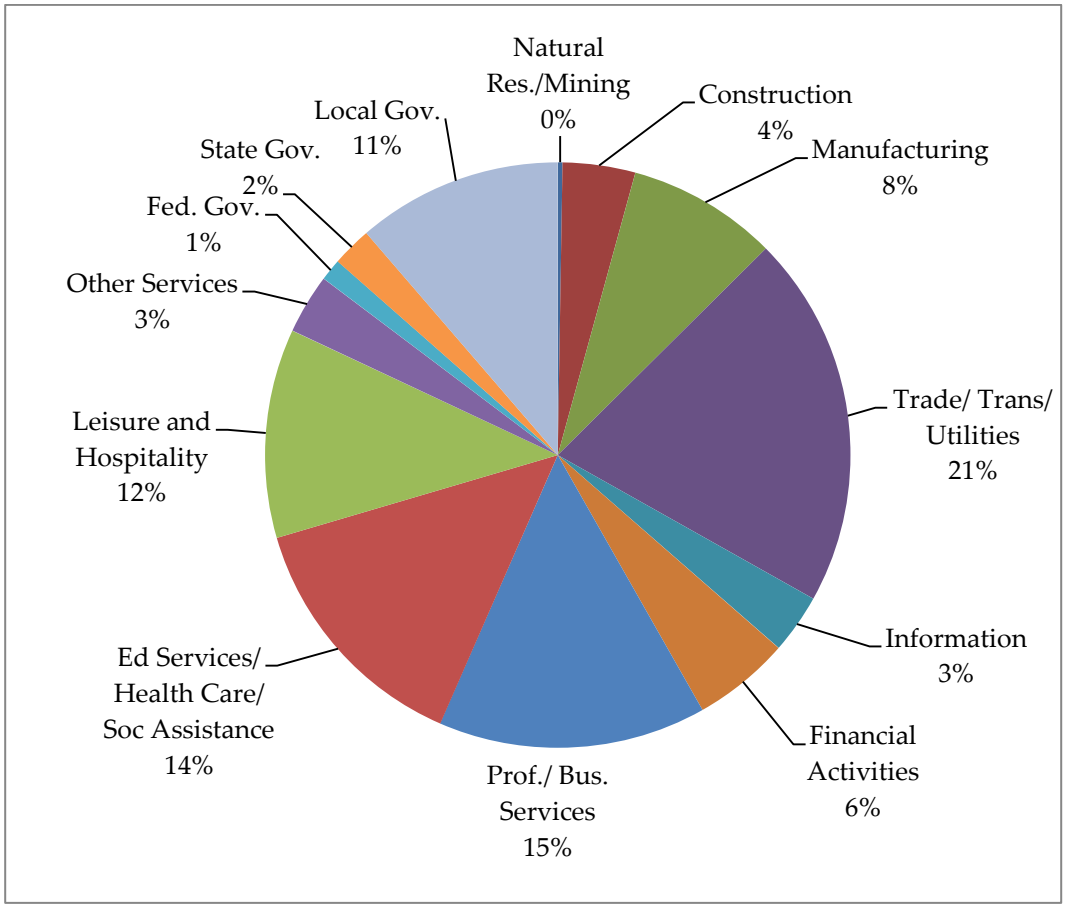
Figure C-13: Employment in SCE Service Area, by Industry, 2010[51]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

[51] Available data for Alpine, Inyo, Mono and Ventura Counties are for 2008 rather than 2010.

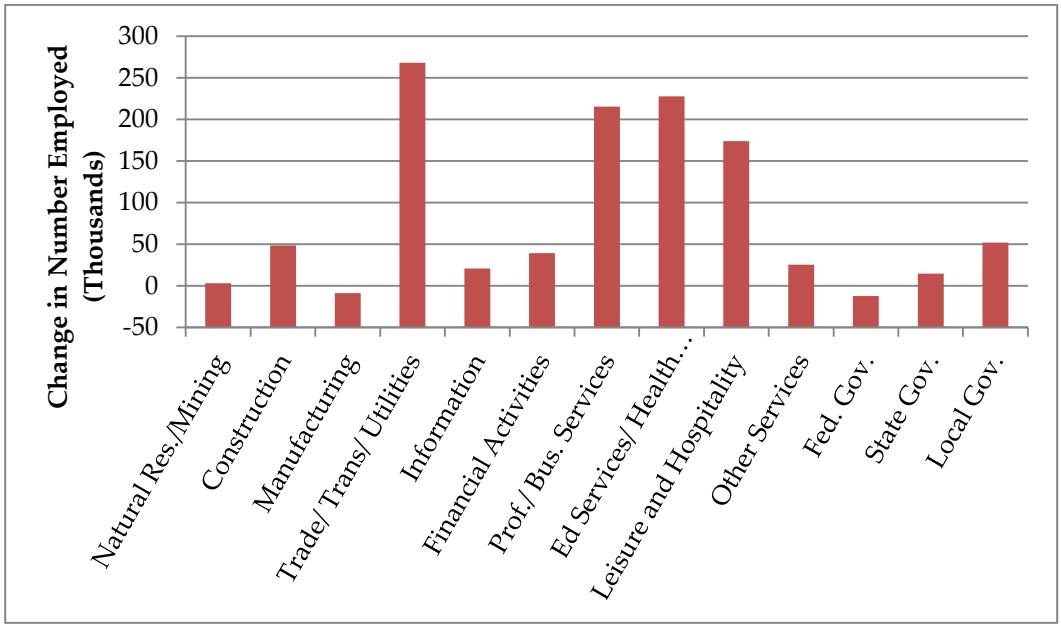
Figure C-14: Employment in SCE Service Area, by Industry, 2020[52]



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

[52] Available data for Alpine, Inyo, Mono and Ventura Counties are for 2018 rather than 2020.

Figure C-15: Change in Employment in SCE Service Area, by Industry, 2010 through 2020[53]



Sources: State of California - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

SDG&E Service Area

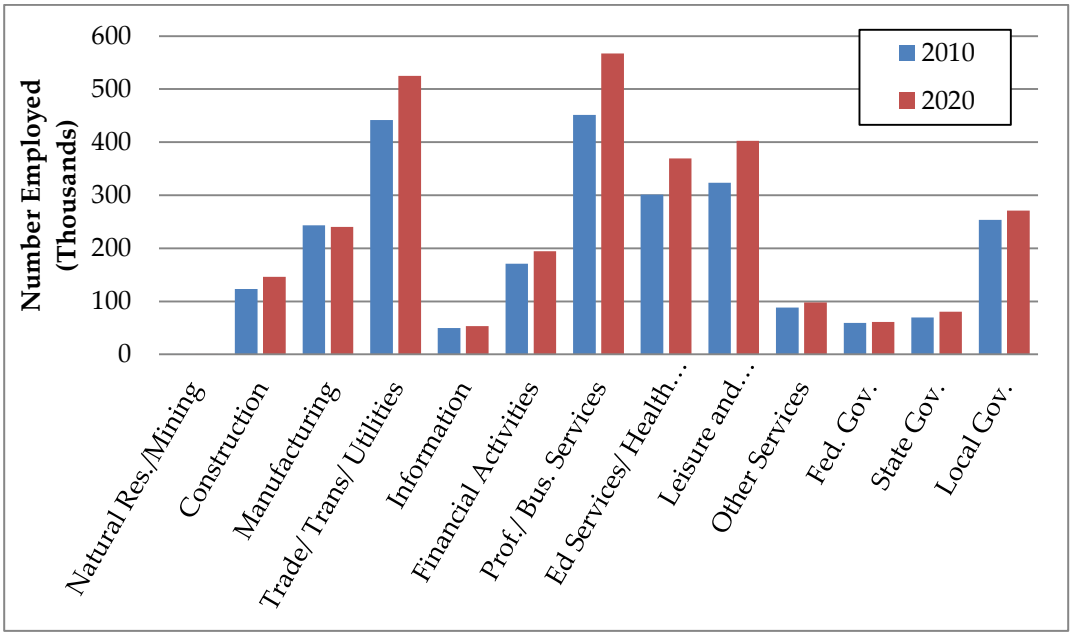
According to California's EDD and as shown in Figure C-16 and Figure C-17, the industries with the largest share of employment in the SDG&E's service area in 2010 were professional and business services (451,200 jobs or 17.5 percent), followed by, trade, transportation, and utilities (441,700 jobs or 17.1 percent) and leisure and hospitality (323,400 jobs or 12.6 percent).

Figure C-18 illustrate that in 2020 the largest share of employment is projected to be in those same three industries that are the top industries today, with professional and business services at 18.8 percent, trade, transportation, and utilities having 17.4 percent of jobs, and leisure and hospitality with 13.4 percent.

The largest growth rate from 2010 to 2020, as illustrated in Figure C-19, is forecasted to be in the following industries: professional and business services (25.6 percent), leisure and hospitality (24.5 percent), and educational and health services, which will grow 22.8 percent to 369,600 jobs.

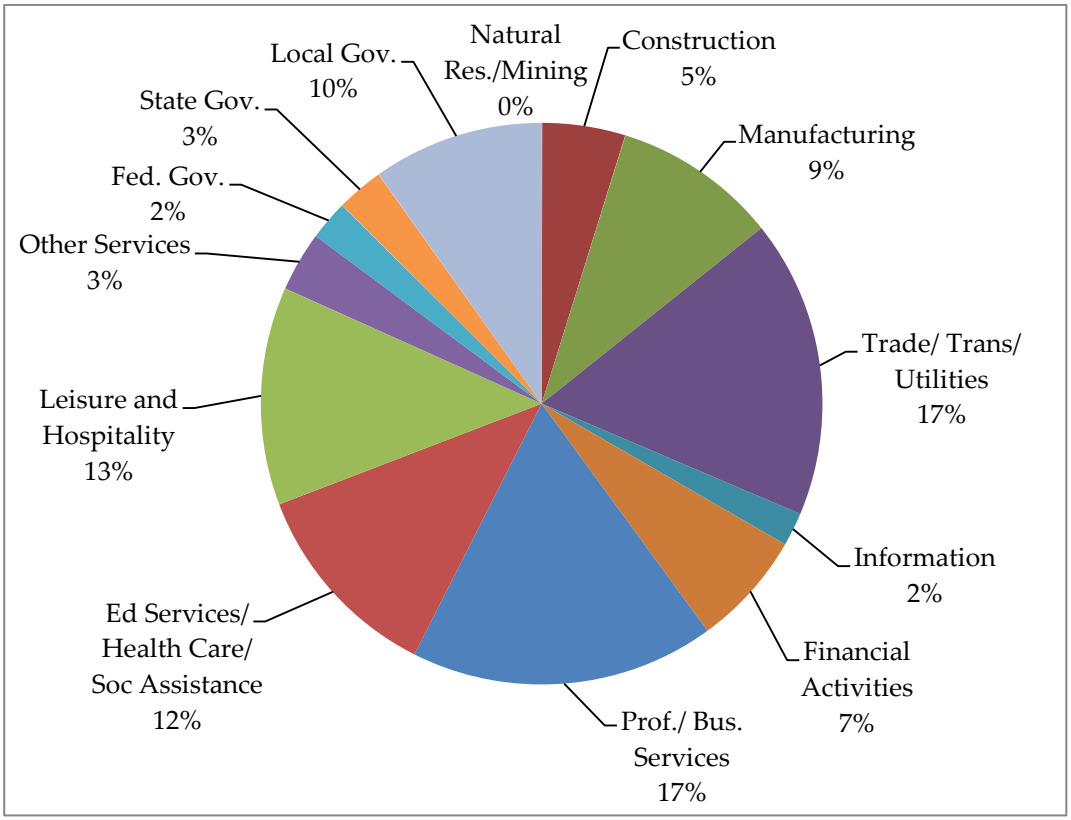
[53] Available data for Alpine, Inyo, Mono and Ventura Counties are for 2008 and 2018 rather than 2010 and 2020.

Figure C-16: Employment in SDG&E Service Area, by Industry, 2010 and 2020



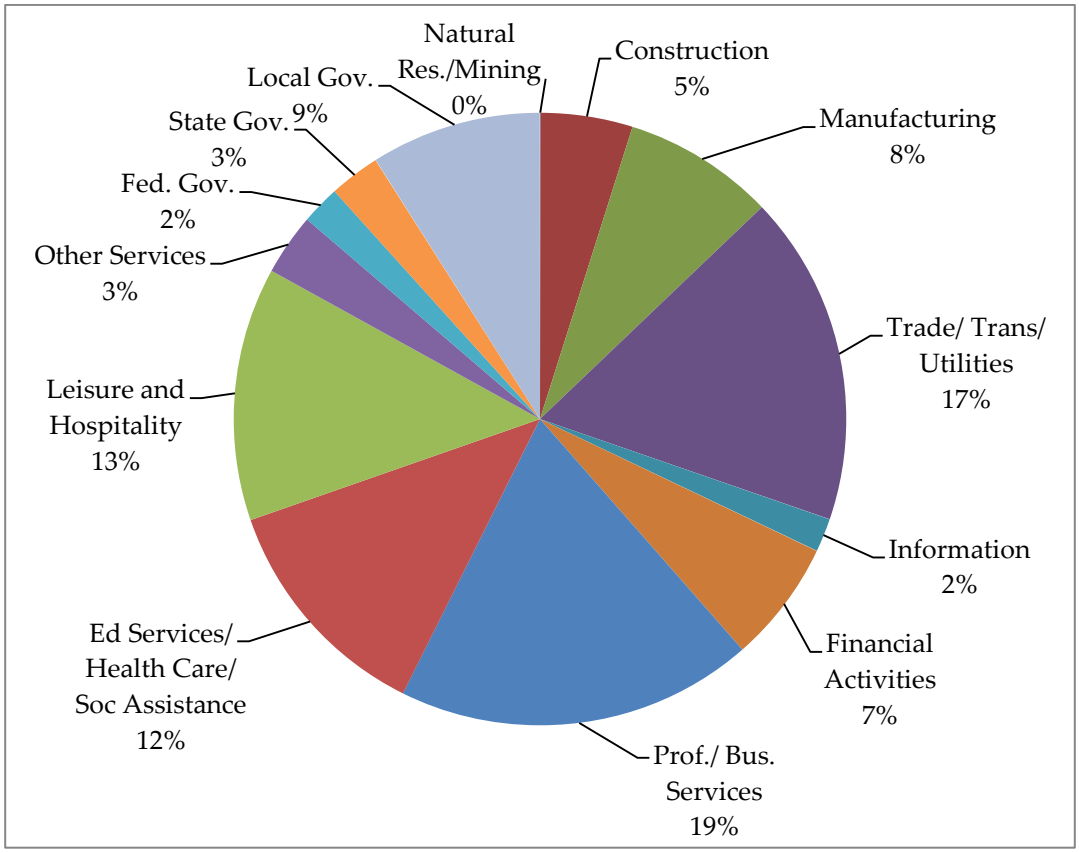
Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

Figure C-17: Employment in the SDG&E Service Area, by Industry, 2010



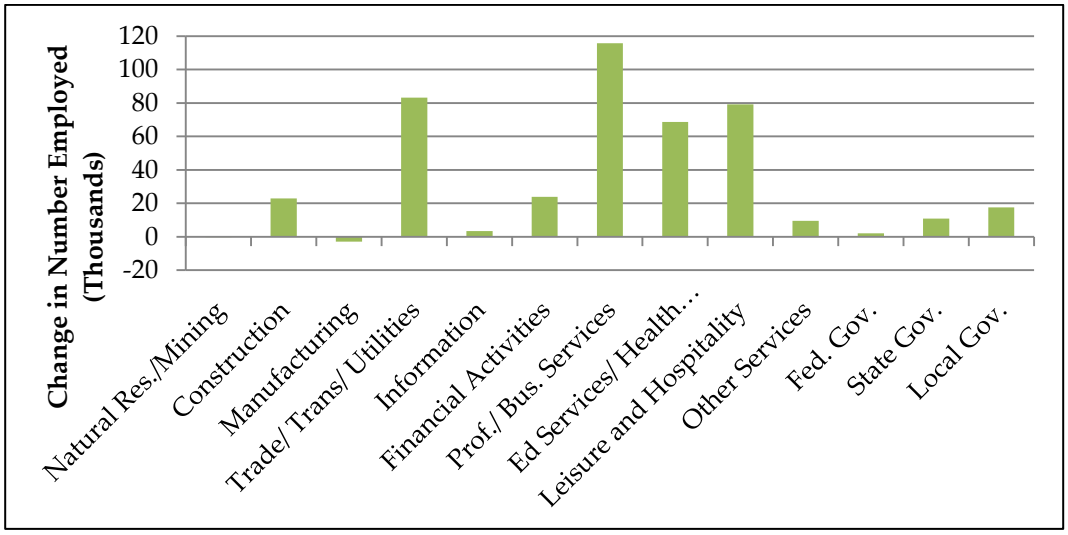
Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

Figure C-18: Employment in the SDG&E Service Area, by Industry, 2020



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

Figure C-19: Change in Employment in the SDG&E Service Area, by Industry, 2010 through 2020



Sources: State of California EDD - U.S. Bureau of Labor Statistics' Current Employment Statistics March 2011 Benchmark and Quarterly Census of Employment and Wages (QCEW).
http://www.labormarketinfo.edd.ca.gov/

C.5 Implications for the SBD Program

The macro statistics and projections discussed in this appendix provide useful information for anticipating nonresidential building market trends in the service territories for PG&E, SCE and SDG&E. Additionally, these trends will be important in developing the background for future Program planning. Given the continuing uncertainty concerning the state of the national and international economies, the projections must be used cautiously and considered in a broad context based on all of information presented in this report.

Although the different ways business types are classified by various organizations (e.g., McGraw Hill and California EDD) 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. These include:

- **Public-Private Partnerships (PPP)**: Given the continuing constriction of public spending, the Program should consider ways to facilitate and leverage PPP opportunities. This will likely be particularly useful for local government and public K-12 educational facilities. There may be opportunities for cooperation with the IOUs' Local Government Partnerships. The 2008 *SDG&E New Construction Process Evaluation Study Report* made a similar recommendation.[54]
- **Major Renovations**: Current economic conditions have caused an increase in major renovations of existing facilities as an alternative to new construction – frequently repositioning them for

[54] Heschong Mahone Group, Inc. and The Cadmus Group, Inc., *SDG&E New Construction Process Evaluation Study Report* (August 12,2008), 35. "The utility could build upon this sort of innovative financing model by actively encouraging and facilitating it to produce greater savings and renewable than would otherwise be possible."

different industry use (e.g., big box retail stores being renovated as healthcare facilities). The Program should ensure it is fully prepared to take advantage of opportunities in this area.

- **Training Opportunities**: With the downturn in construction activity and spending, construction workers are leaving the industry. To help ensure a workforce trained in the areas of energy efficiency and green building is in place when the market rebounds, the Program may want to consider expanding its training and outreach activities. Offering such services aligns with past Program evaluations which have found that frequently participants found the technical assistance and support offered by the Program more beneficial than the financial incentives.
- **EM&V for Non-financial Benefits**: Given the increased financial pressures being felt by both public and private entities due to the recession, the additional benefits of investment in energy efficient need to be promoted to decision-makers. A 2012 McGraw-Hill study found that "in order for green building to continue to gain market share at a comparable rate to the past decade, more far-reaching benefits need to be documented and demonstrated to organizational leadership. These additional benefits can be projected across the spectrum of financial, environmental and social fields—often referred to as the 'triple bottom line.'"[55] The Program may want to consider expanding its EM&V activities to evaluate both the nonfinancial (social and environmental) and financial benefits of efficient buildings.
- **Distribution Centers**: The expansion of the Panama Canal may lead to an increased need for distribution centers inland from Post Panamax -Ready ports (including Oakland, Los Angeles/Long Beach and San Diego). Additionally, with the continuing increase in online retail sales, distribution centers will likely expand.
- **Manufacturing**: Although the industry employment projections may not be as impressive for the manufacturing sector as compared others, it may be one to watch, as American onshore production continues to grow and natural gas prices stay relatively low. However, California's stringent environmental regulations, tax rates and infrastructure may hinder growth in this area. Employment numbers may be somewhat deceiving, as technological advances are lessening the need for employees in this sector, so low employment increases could still mean significant increases in building square footage within this sector.
- **Professional and Business Services**: The professional and business service industry is projected to have the largest growth across each of the three IOU service areas. While there will likely be some continuing reduction in office space needs (due to an increase in telecommuting, etc.), some areas, such as Silicon Valley, are expected to be adding jobs at a strong enough pace to create demand for additional office space in the near term. The increase in trade/transportation/utilities employment likely also points to growth in construction activity in this sector. Given past Program evaluation findings that property management companies have been underserved, the Program should consider expanding its outreach to these companies specifically.
- **Information**: While the overall number of jobs in this sector is not the largest, its growth rate is projected to be considerable. Given the increasing demand for communications/data centers with changes in computing standards, this may be an area of consideration for Program focus.

[55] McGraw-Hill Construction, "Better Metrics of Green Benefits Needed, According to New McGraw-Hill Construction SmartMarket Executive Brief on Decision Making for Green Building Investments," (September 24, 2012)

- **Educational and Health Care Services**: Both new and re-purposed space is likely to be needed in the healthcare sector. This includes suburban satellite medical offices as well as assisted living and special-care facilities, which should become increasingly in demand with the aging U.S. population. Construction is also expected to pick-up in the educational sector, particularly for higher education and private education. However, this may also expand to public K-12 with bond measures anticipated for 2014.
- **Leisure and Hospitality**: Considerable growth is projected in this industry in SCE's and SDG&E's service areas, which should mean an uptick in construction and major renovation. The leisure and hospitality industry typically needs more technical assistance and outreach than other sectors. SCE and SDG&E may want to consider having resources available to address the market needs.

Appendix D. Construction Activity

D.1 New Construction Activity Calculations

New construction activity includes both the construction of new buildings as well as the addition of new floor space to existing buildings. Consistent with similar previous analysis, new construction projections were obtained from Dodge Reports from McGraw-Hill Construction (Dodge data). Dodge data provided new construction starts (permits) for a given year in total square feet of nonresidential construction by year, quarter and county from 2003 through 2015. IOU program participants are tracked based on when a project is completed; thus to effectively use Dodge data, Navigant had to convert new construction starts (permits) to new construction completions. Data from the U.S. Census provided information on the average number of months from start to completion for various commercial building types.[56] Additionally, Navigant assumed 2.5 percent of commercial construction projects that start are never completed.[57] These two assumptions allowed Navigant to convert Dodge Data from starts to completions.

Dodge data was broken down by county for all California counties. However; several counties contain more than one IOU service territory. To separate county level data into each IOU, Navigant created an IOU-County map to document the percent of each county residing in each IOU service territory.

D.2 Existing Building Renovation Activity Calculations

A portion of the existing commercial building floor space can be expected to undergo major renovations in any given year. Navigant expects, based on Rocky Mountain Institute data,[58] major renovations in commercial buildings occur every 20-30 years (based on the need for HVAC equipment changes). For the purpose of this study, Navigant assumes the average building will undergo a major renovation every 25 years. To put this in practical terms, a building constructed in 1970 was likely renovated in 1995 and may also consider another renovation in 2020.

Navigant assumes the existing building floor space is evenly distributed in age.[59] This implies that in any given year, 1/25th of the existing building stock has reached its "25-year milestone" at which point the building owner is considering a renovation. Navigant estimated future eligible renovation floor space by taking the 2006 existing building stock and estimating 1/25th of this floor space would consider a renovation in 2007, a separate 1/25th of the floor space would consider it in 2008, and so on. This method to estimating eligible building stock is common practice in energy efficiency potential modeling.[60]

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[56] http://www.census.gov/const/avg_starttocomp.pdf

[57] Based on Navigant's experience in the commercial new construction market.

[58] *Reinventing Fire*, Amory Lovins and Rocky Mountain Institute (2011)

[59] Navigant understands that historically construction boom and busts have characterized the market and thus make for an "uneven" distribution of commercial buildings in the region. However, Navigant does not believe that referencing the year-to-year variation of historic construction rates will add much understanding.

[60] Navigant has undertaken numerous energy efficiency potentials studies that have incorporated assumptions about technology turnover, burnout, and replacement that incorporated methodologies similar to the approach adopted here. Most recent amongst these is the CPUC's Potentials, Goals and Targets study, which was completed

Existing building stock in 2006 was sourced from the 2011 California Energy Commission's Integrated Energy Policy Report (IEPR).[61] The IEPR provides the existing building stock for each IOU service territory by building type; however the building types used by the CEC do not directly match those used by Dodge. A common building type mapping was used to cross reference the Dodge building types and the CEC building types. CEC building stock data was rolled up to the common building type level and then distributed to the Dodge building type level using the ratio of new construction activity by building type available from Dodge as reported in Table D-1.

Table D-1: Dodge and CEC Building Type Mapping

Dodge Building Types	Common Building Types	CEC Building Types
Manufacturing Plants, Warehouses, Labs	Manufacturing Plants, Warehouses, Labs	Ref. Warehouse
Warehouses (excl. manufacturer owned)		Warehouse
Office and Bank Buildings	Office	Large Office
Government Service Buildings		Small Office
Hospitals and Other Health Treatment	Healthcare	Hospital
Stores and Restaurants	Stores and Restaurants	Retail
		Restaurant
		Grocery
Dormitories	Education	College
Schools, Libraries, and Labs (nonmfg)		School
Hotels and Motels	Lodging	Hotel
Parking Garages and Automotive Services	Misc.	Misc.
Religious Buildings		
Amusement, Social and Recreational Bldgs.		
Miscellaneous Nonresidential Buildings		

Source: Navigant Analysis

Navigant next distributed the existing building stock data to each county in California. This distribution was made using data from the California Department of Finance's County Profiles. The county profiles provide information on the number of businesses by county; Navigant assumed the relative number of business in each county was a good proxy for the relative amount of commercial floor space in each county. Navigant generated a statewide distribution of the number of buildings in each county using the Department of Finance Data.

by Navigant in 2012 and can be found at:
http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/Energy+Efficiency+Goals+and+Potential+Studies.htm

[61] Available at: http://www.energy.ca.gov/2011_energypolicy/documents/2011-08-30_workshop/mid-case/

Table D-2: Total New Construction Completions by County (Thousand Square Feet)

County	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ALAMEDA	4,052	3,876	2,617	2,970	2,361	1,220	1,623	1,943	2,169	2,768
ALPINE	0	0	0	0	0	0	0	0	0	0
AMADOR	387	60	5	9	19	0	4	28	78	7
BUTTE	406	365	384	369	74	83	135	136	267	247
CALAVERAS	34	246	86	42	14	8	341	175	131	138
COLUSA	17	0	9	0	10	0	8	30	9	11
CONTRA COSTA	2,423	2,764	2,515	1,473	944	618	570	665	975	1,273
DEL NORTE	0	0	0	0	0	0	0	0	0	0
EL DORADO	783	324	1,450	171	79	66	90	112	240	367
FRESNO	1,765	1,644	2,944	665	468	347	451	649	858	909
GLENN	19	11	0	0	0	49	13	21	16	19
HUMBOLDT	39	104	346	187	90	79	142	126	220	241
IMPERIAL	26	65	20	11	9	1	7	6	7	8
INYO	26	1	5	9	16	0	0	1	3	5
KERN	2,726	2,262	1,777	2,095	539	494	498	634	756	990
KINGS	443	113	289	401	204	171	50	161	258	367
LAKE	26	179	804	39	7	0	84	57	104	165
LASSEN	0	9	3	3	0	11	0	5	4	4
LOS ANGELES	13,369	12,804	11,523	8,553	4,531	5,944	3,169	5,378	6,745	8,767
MADERA	713	669	540	193	68	25	85	130	224	160
MARIN	164	351	779	239	237	177	37	211	247	285
MARIPOSA	155	8	17	0	51	0	2	13	12	16
MENDOCINO	58	62	1	75	15	95	28	74	86	61
MERCED	890	696	634	557	104	334	364	412	440	516
MODOC	0	0	0	0	0	0	0	0	0	0
MONO	63	9	0	0	3	18	15	8	8	8
MONTEREY	1,050	958	811	475	600	169	341	345	377	486
NAPA	699	585	1,350	1,122	48	180	196	300	417	512
NEVADA	160	166	238	105	52	51	9	36	47	63
ORANGE	13,317	10,852	5,315	3,890	3,043	2,475	2,454	2,548	3,725	4,501
PLACER	2,470	2,335	1,565	1,009	1,872	217	52	272	576	878
PLUMAS	31	7	5	12	18	0	0	1	3	5
RIVERSIDE	13,421	12,738	10,139	5,868	1,453	3,576	1,473	2,649	3,495	4,994
SACRAMENTO	379	233	247	195	52	36	69	54	94	116
SAN BENITO	0	14	134	26	28	32	105	89	117	88
SAN BERNARDINO	16,380	22,018	13,974	5,106	4,310	3,058	4,098	4,011	5,233	7,169
SAN DIEGO	14,969	11,348	8,636	7,784	5,195	8,058	5,296	6,538	7,896	9,929

County	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAN FRANCISCO	3,684	1,905	1,591	936	733	636	1,817	1,875	1,675	1,869
SAN JOAQUIN	1,781	2,274	6,084	1,019	771	494	3,019	2,120	1,835	2,251
SAN LUIS OBISPO	652	2,293	423	553	256	534	389	424	486	492
SAN MATEO	1,498	2,325	2,079	1,197	790	345	639	863	976	1,217
SANTA BARBARA	1,189	1,443	706	644	574	3,024	418	520	858	910
SANTA CLARA	5,823	5,968	7,683	2,758	1,880	1,718	2,456	2,569	3,292	4,127
SANTA CRUZ	1,319	300	298	191	255	58	14	69	165	158
SHASTA	244	242	168	251	18	28	276	258	239	224
SIERRA	0	2	0	0	0	0	0	0	0	0
SISKIYOU	3	6	1	1	0	1	2	1	1	1
SOLANO	2,301	1,690	353	763	232	852	20	723	614	577
SONOMA	1,584	799	863	685	214	92	340	283	402	474
STANISLAUS	1,059	259	393	391	441	151	123	323	259	334
SUTTER	278	116	79	22	18	33	92	33	63	109
TEHAMA	66	103	32	71	123	0	66	53	63	76
TRINITY	3	42	3	0	0	2	0	1	1	1
TULARE	2,447	1,846	1,878	426	423	694	606	614	638	823
TUOLUMNE	190	107	84	43	165	39	1	61	57	60
VENTURA	1,708	1,263	2,069	1,312	792	729	214	593	866	1,232
YOLO	592	2,088	1,476	537	476	367	756	499	778	890
YUBA	83	106	396	131	61	102	0	41	93	113
Total	**117,963**	**113,051**	**95,820**	**55,583**	**34,739**	**37,489**	**33,055**	**39,742**	**49,202**	**62,010**

Source: Dodge and Navigant Analysis

Table D-3: PG&E New Construction Completions by Building Type (Thousand Square Feet)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	1,160	1,794	1,691	1,215	817	608	442	449	962	1,242
Dormitories	241	1,448	551	677	308	276	173	466	737	642
Government Service Buildings	947	645	1,524	606	726	416	1,682	1,661	1,377	1,240
Hospitals and Other Health Treatment	947	645	1,524	606	726	416	1,682	1,661	1,377	1,240
Hotels and Motels	1,337	1,739	1,282	905	254	180	351	759	959	1,013
Manufacturing Plants, Warehouses, Labs	1,988	1,215	1,087	281	706	706	284	762	892	1,092
Miscellaneous Nonresidential Buildings	1,433	610	632	619	395	1,934	1,599	1,052	1,133	1,109
Office and Bank Buildings	6,388	7,472	7,369	2,404	1,080	1,239	1,307	1,759	2,203	2,845
Parking Garages and Automotive Services	6,439	5,546	7,077	2,706	2,733	704	1,924	2,560	3,330	4,019
Religious Buildings	559	532	344	264	187	209	92	99	150	97
Schools, Libraries, and Labs (nonmfg)	6,564	7,184	4,271	5,391	3,043	2,976	2,878	2,337	2,636	3,360
Stores and Restaurants	8,995	7,504	6,807	2,835	2,208	1,632	2,383	2,493	2,654	3,546
Warehouses (excl. manufacturer owned)	4,712	3,136	7,868	3,203	1,498	575	826	1,127	1,779	2,683

Source: Dodge and Navigant Analysis

Table D-4: SDG&E New Construction Completions by Building Type (Thousand Square Feet)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	307	750	385	320	149	125	145	107	220	311
Dormitories	9	459	18	1,211	1,056	1,784	222	964	1,318	1,440
Government Service Buildings	131	173	200	711	861	259	195	279	342	520
Hospitals and Other Health Treatment	131	173	200	711	861	259	195	279	342	520
Hotels and Motels	2,182	672	746	213	0	443	233	443	528	627
Manufacturing Plants, Warehouses, Labs	1,068	415	178	0	0	0	17	22	38	61
Miscellaneous Nonresidential Buildings	187	30	173	32	108	423	70	320	216	200
Office and Bank Buildings	2,824	2,526	2,003	635	102	719	732	745	913	1,205
Parking Garages and Automotive Services	3,443	3,182	2,443	1,522	1,044	1,492	1,614	1,573	1,887	2,273
Religious Buildings	273	174	67	261	33	108	12	21	85	52
Schools, Libraries, and Labs (nonmfg)	1,927	1,838	898	1,584	938	2,005	1,611	1,151	1,130	1,422
Stores and Restaurants	2,218	992	799	504	135	473	355	499	667	915
Warehouses (excl. manufacturer owned)	978	541	809	286	70	100	24	271	407	623

Source: Dodge and Navigant Analysis

Table D-5: SCE New Construction Completions by Building Type (Thousand Square Feet)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	881	2,017	1,036	1,205	591	908	457	543	925	1,314
Dormitories	527	420	113	1,178	544	610	80	281	597	790
Government Service Buildings	716	848	632	1,093	692	778	761	923	752	881
Hospitals and Other Health Treatment	716	848	632	1,093	692	778	761	923	752	881
Hotels and Motels	1,086	2,673	1,373	750	179	361	437	524	655	766
Manufacturing Plants, Warehouses, Labs	2,507	3,757	1,846	1,663	27	2,194	77	727	1,067	1,603
Miscellaneous Nonresidential Buildings	439	473	1,190	468	1,057	1,310	49	353	398	563
Office and Bank Buildings	8,260	6,720	4,527	1,495	762	611	851	756	1,064	1,568
Parking Garages and Automotive Services	9,487	9,184	6,182	3,909	1,887	2,469	1,346	2,932	3,678	4,266
Religious Buildings	906	548	485	367	632	92	153	80	115	139
Schools, Libraries, and Labs (nonmfg)	5,041	5,605	5,582	5,656	3,530	3,723	2,204	1,949	2,401	3,083
Stores and Restaurants	10,235	9,776	9,959	2,968	1,585	1,614	2,048	2,697	3,697	5,267
Warehouses (excl. manufacturer owned)	19,773	18,789	11,317	4,033	2,521	1,980	2,784	3,196	4,818	6,590

Source: Dodge and Navigant Analysis

Table D-6: Annual Existing Building Renovations by Building Type (Thousand Square Feet)

Building Type	PG&E	SCE	SDG&E
Amusement, Social and Recreational Bldgs.	1,699	823	221
Dormitories	378	1,312	13
Government Service Buildings	2,221	866	267
Hospitals and Other Health Treatment	4,049	9,658	1,204
Hotels and Motels	3,859	9,451	1,509
Manufacturing Plants, Warehouses, Labs	3,236	1,863	1,373
Miscellaneous Nonresidential Buildings	2,099	410	135
Office and Bank Buildings	14,974	9,996	5,746
Parking Garages and Automotive Services	9,431	8,866	2,482
Religious Buildings	819	847	197
Schools, Libraries, and Labs (nonmfg)	10,315	12,554	2,834
Stores and Restaurants	16,899	19,195	5,533
Warehouses (excl. manufacturer owned)	7,672	14,693	1,258
Total	**77,652**	**90,534**	**22,771**

Source: CEC and Navigant Analysis

Table D-7: Total New Construction Completions by County (Thousand Square Feet)

County	Percent of Statewide Existing Buildings
ALAMEDA	4.55%
ALPINE	0.01%
AMADOR	0.11%
BUTTE	0.58%
CALAVERAS	0.12%
COLUSA	0.05%
CONTRA COSTA	2.78%
DEL NORTE	0.06%
EL DORADO	0.49%
FRESNO	1.93%
GLENN	0.06%
HUMBOLDT	0.46%
IMPERIAL	0.29%
INYO	0.08%
KERN	1.37%
KINGS	0.19%
LAKE	0.14%
LASSEN	0.07%
LOS ANGELES	28.35%
MADERA	0.24%
MARIN	1.29%
MARIPOSA	0.04%
MENDOCINO	0.35%
MERCED	0.37%
MODOC	0.03%
MONO	0.07%
MONTEREY	1.09%
NAPA	0.46%
NEVADA	0.37%
ORANGE	9.75%
PLACER	0.88%
PLUMAS	0.09%
RIVERSIDE	3.28%
SACRAMENTO	3.23%
SAN BENITO	0.12%
SAN BERNARDINO	3.41%

County	Percent of Statewide Existing Buildings
SAN DIEGO	8.40%
SAN FRANCISCO	3.98%
SAN JOAQUIN	1.27%
SAN LUIS OBISPO	0.86%
SAN MATEO	2.58%
SANTA BARBARA	1.36%
SANTA CLARA	5.72%
SANTA CRUZ	0.87%
SHASTA	0.56%
SIERRA	0.01%
SISKIYOU	0.16%
SOLANO	0.81%
SONOMA	1.68%
STANISLAUS	1.04%
SUTTER	0.21%
TEHAMA	0.13%
TRINITY	0.04%
TULARE	0.75%
TUOLUMNE	0.18%
VENTURA	2.14%
YOLO	0.44%
YUBA	0.11%
Total	**100%**

Source: California Department of Finance's County Profiles and Navigant Analysis

Appendix E. Future Potential Sensitivity Analysis

Navigant attempted to conduct a sensitivity analysis on the future potential for the SBD program. The initial intent was to develop three different future savings scenarios:

- **Scenario 1: Continued Participant Savings:** In this scenario Navigant planned to estimate savings per square foot (kWh/sqft) using historic SBD participation data and the same method that was used by the *2011 SCE SBD Study*. Savings for Scenario 1 were developed and presented in the main body of this report.
- **Scenario 2: Reduced Savings as a Result of New Construction Codes and Appliance Standards:** Savings developed in Scenario 1 may not be an accurate estimate of future savings as codes and standards (C&S) may decrease claimable savings. Navigant planned to make a high level adjustment of the impact of C&S on SBD participant savings. Navigant planned to leverage data available from the CEC of the impact of new construction building codes on energy use to adjust historical SBD savings downwards. Scenario 2 would have represented a "low case" for future savings potential.
- **Scenario 3: Increased Savings from Zero Net Energy Construction:** Navigant planned to use Scenario 3 to represent a "high case" for future savings potential. The greatest energy efficiency savings in the new construction market are a result of building design optimization through the construction of a ZNE building. Navigant planned to leverage ZNE savings data reported in *The Technical Feasibility of Zero Net Energy Buildings in California* study.[62]

Ultimately, the lack of alignment between multiple data sources prevented Navigant from conducting a robust sensitivity analysis. These alignment issues include:

- **Lack of Common Building Type Definition across Multiple Analyses**: This analysis uses Dodge data to define 13 different non-residential building types. CEC new construction code analysis only examined a subset of six of the most common building types in California (Hotel, Large Office, Restaurant, Retail, School, and Warehouse). ARUP analysis of ZNE buildings examined 11 different commercial building types. Lack of building type alignment makes leveraging data from multiple sources by building type very difficult and reduces the quality of any analysis.
- **Lack of Common Basis for Building Codes**: Historic savings calculated for Scenario 1 represent those estimated by the IOUs and reported in program tracking database. Navigant postulates the savings reported by the IOUs are relative to a baseline that includes any new construction codes that are entering the marketplace at the time that the building was constructed. Given participation data is available back to 2006 it is possible that historic participation data has two inherent baselines (2005 Title 24 and 2008 Title 24) depending on when buildings were constructed. Multiple data sets of the savings due to new Title 24 codes are available from the CEC with baselines of 2005 Title 24 and 2008 Title 24. However, ARUP analysis of ZNE savings was relative to ASHREA 90.1- 2010. The inability to come up with a common baseline at the building type makes any analysis difficult and would reduce the quality of results.

[62] ARUP. *The Technical Feasibility of Zero Net Energy Buildings in California*. Developed for PG&E, SCE, SDG&E, and SCG. December 2012.

» **Inclusion of Existing Building Renovations in Historical Participant Data**: While the majority of SBD participants were/are constructing new buildings, anecdotal information from the SBD program managers indicated a portion of participants (10-30% depending on the year and utility) are conducting major renovations of existing buildings through SBD. Inclusion of existing building participants in both historical data and future savings projects complicates the consideration of build codes impacts and ZNE. New construction building codes can apply to major renovations of existing buildings, though the applicability of codes depends on the extent of the renovation. Without knowing the extent of renovation, a code baseline cannot be set. Additionally, many existing buildings cannot be retrofitted to reach ZNE goals. Without detailed information on the type of project (new construction vs. existing building renovation) and the extent of existing building renovations, analysis of the impacts of building codes and ZNE building practices will not produce a robust analysis.

Appendix F. PG&E Detailed Program Market Potential Results

This appendix provides a detailed discussion of PG&E analysis and results.

F.1 Methodology and Data Sources

Analysis of PG&E data followed the methodology outlined in *Section 1-Introduction & Methodology*, with some additional calculations to address data gaps (described further below).

Data was provided by PG&E program managers containing the following key information for each SBD participant from 2006 to 2012:

- Program year
- Energy Savings (kWh, kW, and Therms)
- Square footage
- Building type

The building types provided by PG&E did not match exactly to the Dodge building types. Navigant mapped each PG&E building type classification to a Dodge building type and provided the mapping to PG&E staff for review.

PG&E data contained several data gaps related to building type and square footage:

1. 60 percent of participants (based on total kWh savings) from program years 2006 - 2012 had a square footage value populated, the rest of participants were missing data.
2. 35 percent of participants (based on total kWh savings) from program years 2006 – 2012 have both a have a square footage and building type value populated, the rest of participants are missing either one or both data points
3. The portion of participants that do not have a building type provided is rather high for 2006 – 2009 as documented in Table F-1.

Table F-1: Proportion of Missing Square Footage Data for PG&E

	2006	2007	2008	2009
Percent of participants (based on total savings) missing square footage data	40%	49%	84%	90%

Source: Navigant Analysis

The quality of data from 2010 to 2012 was much higher relative to the aggregate data: all participants have a building type value populated during this period, though a portion was still missing a square footage value.

Navigant undertook a process to fill the missing data for square footage and building types to be able to use the PG&E data in this analysis. This methodology is summarized below and was shared with PG&E staff prior to implementing.

1. **Calculate Savings per Square Foot:** Savings per square foot by building type were calculated for the 35 percent of participants that had both square footage and building type data populated. This was calculated as a single value across all program years (2006 – 2012) for each building type.
2. **Estimate Square Footage Where Possible**. For participants that listed a building type but were missing square footage, Navigant used the average savings per square foot calculated in step 1 and the participant savings to estimate the square footage of the participant.
3. **Distribute Data for Remaining Unknown Building Types**. After conducting step 2, a subset of participants remained that had neither building type nor square footage data populated (these participants were found in program years 2006-2009). The savings for these participants were added together as a total savings value; a total square footage value was calculated using the same process as step 2 using total savings. The total savings and square footage was then distributed to each building type based on the ratio of savings and square footage data from program years 2010 to 2012 (the most robust data set available).

The above steps provided a total savings and square footage value by building type and program year that could then be used in the subsequent PG&E analysis.

F.2 Program Market Penetration

PG&E's SBD program market penetration varies by building type as listed in Table F-2. Historically the highest participation rates were achieved in *Manufacturing Plants, Warehouses, Labs* (83 percent), *Government Service Buildings* (37 percent) and *Miscellaneous Nonresidential Buildings* (36 percent) while the lowest participation rates were observed in *Parking Garages and Automotive Services* (0 percent), *Amusement, Social and Recreational Bldgs.* (1 percent), and *Dormitories* (0 percent).

Table F-2: PG&E SBD Participation Rate by Building Type, 2006-2012

Building Type	Average Participation Rate
Amusement, Social and Recreational Bldgs.	1%
Dormitories	0%
Government Service Buildings	37%
Hospitals and Other Health Treatment	15%
Hotels and Motels	1%
Manufacturing Plants, Warehouses, Labs	83%
Miscellaneous Nonresidential Buildings	36%
Office and Bank Buildings	7%
Parking Garages and Automotive Services	0%
Religious Buildings	3%
Schools, Libraries, and Labs (nonmfg)	14%
Stores and Restaurants	15%
Warehouses (excl. manufacturer owned)	14%
All Building Types	**14%**

Source: Navigant Analysis

PG&E's overall participation rate in SBD by year is documented in Table F-3. PG&E customer participation in SBD generally increased from 2006 to 2009. Participation rate decreased in the following years.

Table F-3: PG&E SBD Participation Rate by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
Participation Rate	11%	15%	13%	34%	15%	6%	3%

Source: Navigant Analysis

F.3 Historic Program Savings and Savings per Square Foot

PG&E's SBD historic electric, demand, and gas savings by building type and by year are documented in Table F-4, Table F-5, and Table F-6, respectively. Five building types account for 85 percent of the historic electric savings (MWh) and 72 percent of the historic demand savings (MW): *Hospitals and Other Health Treatment*; *Manufacturing Plants, Warehouses, Labs*; *Miscellaneous Nonresidential Buildings*; *Office and Bank Buildings*; and *Stores and Restaurants*. Five building types account for 88 percent of the historic gas savings: *Hospitals and Other Health Treatment*; *Manufacturing Plants, Warehouses, Labs*; *Office and Bank Buildings*; *Schools, Libraries, and Labs (nonmfg)*; and *Stores and Restaurants*. Negative values reported for gas savings represents interactive effects from electric efficiency measures that result in increased gas usage by a customer.

Table F-4: PG&E SBD Savings Building Type and Year (MWh)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	19	28	47	103	50	0	0	**248**
Dormitories	0	0	0	0	0	0	0	**0**
Government Service Buildings	653	1,692	2,110	3,571	929	493	24	**9,472**
Hospitals and Other Health Treatment	4,088	3,983	7,976	14,377	8,081	146	200	**38,852**
Hotels and Motels	16	17	38	66	0	0	40	**177**
Manufacturing Plants, Warehouses, Labs	37,187	30,527	21,457	42,558	16,908	2,969	1,870	**153,476**
Miscellaneous Nonresidential Buildings	19,798	25,465	5,142	7,948	1,085	509	826	**60,773**
Office and Bank Buildings	6,721	6,259	10,955	8,732	3,185	1,758	101	**37,711**
Parking Garages and Automotive Services	0	58	0	0	0	0	0	**58**
Religious Buildings	111	51	113	194	119	0	0	**589**
Schools, Libraries, and Labs (nonmfg)	4,096	4,060	7,916	13,219	3,689	3,047	380	**36,406**
Stores and Restaurants	11,567	15,434	21,947	38,156	11,157	9,115	2,102	**109,478**
Warehouses (excl. manufacturer owned)	3,826	5,611	2,970	7,315	2,365	238	185	**22,510**
Total	**88,081**	**93,186**	**80,672**	**136,238**	**47,568**	**18,275**	**5,728**	**469,748**

Source: Navigant Analysis

Table F-5: PG&E SBD Savings Building Type and Year (MW)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	0.0	0.0	0.0	0.1	0.0	0.0	0.0	**0.2**
Dormitories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Government Service Buildings	0.4	0.6	0.6	1.9	0.6	0.2	0.0	**4.2**
Hospitals and Other Health Treatment	0.8	0.7	0.8	2.1	1.1	0.1	0.1	**5.7**
Hotels and Motels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.1**
Manufacturing Plants, Warehouses, Labs	5.7	5.2	2.3	5.1	2.3	0.4	0.4	**21.4**
Miscellaneous Nonresidential Buildings	2.9	3.7	1.1	1.9	0.4	0.1	0.3	**10.5**
Office and Bank Buildings	1.2	0.8	1.2	2.0	0.8	0.5	0.1	**6.6**
Parking Garages and Automotive Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Religious Buildings	0.1	0.0	0.1	0.1	0.1	0.0	0.0	**0.3**
Schools, Libraries, and Labs (nonmfg)	2.0	2.0	3.2	5.9	2.1	1.5	0.2	**16.8**
Stores and Restaurants	2.7	3.2	3.4	7.1	3.1	1.5	0.3	**21.2**
Warehouses (excl. manufacturer owned)	0.8	1.0	0.4	1.5	0.5	0.1	0.0	**4.4**
Total	**16.6**	**17.3**	**13.2**	**27.7**	**10.9**	**4.3**	**1.5**	**91.4**

Source: Navigant Analysis

Table F-6: PG&E SBD Savings Building Type and Year (MTherms)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	1	3	4	24	1	0	0	**33**
Dormitories	0	0	0	0	0	0	0	**0**
Government Service Buildings	58	173	192	1,189	43	20	0	**1,675**
Hospitals and Other Health Treatment	360	882	1,287	8,103	438	0	0	**11,070**
Hotels and Motels	12	31	45	282	15	0	0	**386**
Manufacturing Plants, Warehouses, Labs	293	1,577	179	1,224	64	1	1	**3,338**
Miscellaneous Nonresidential Buildings	34	67	78	442	21	0	1	**644**
Office and Bank Buildings	311	139	205	1,425	31	29	8	**2,148**
Parking Garages and Automotive Services	0	0	0	0	0	0	0	**0**
Religious Buildings	9	19	28	178	10	0	0	**244**
Schools, Libraries, and Labs (nonmfg)	81	175	244	1,542	63	18	1	**2,126**
Stores and Restaurants	66	217	336	2,094	69	33	11	**2,827**
Warehouses (excl. manufacturer owned)	-7	81	-27	-152	-10	1	0	**-112**
Total	**1,219**	**3,364**	**2,573**	**16,351**	**746**	**103**	**24**	**24,380**

Source: Navigant Analysis

Navigant subsequently calculated the average savings per square foot ("Participant Savings" in Figure 1-1) for each building type, reported in Table F-7. This value is used to forecast SBD Future Savings Potential.

Table F-7: PG&E SBD Average Savings per Square Foot (2006-2012)

Building Type	kWh/Sqft	kW/Sqft	Therms/sqft
Amusement, Social and Recreational Bldgs.	0.97	0.00073	0.0147
Dormitories	0.00	0.00000	0.0000
Government Service Buildings	1.51	0.00070	0.0469
Hospitals and Other Health Treatment	5.29	0.00111	0.2527
Hotels and Motels	0.42	0.00018	0.1592
Manufacturing Plants, Warehouses, Labs	6.29	0.00103	0.1380
Miscellaneous Nonresidential Buildings	10.19	0.00158	0.0202
Office and Bank Buildings	5.36	0.00077	0.1253
Parking Garages and Automotive Services	0.89	0.00050	0.0000
Religious Buildings	2.45	0.00164	0.1450
Schools, Libraries, and Labs (nonmfg)	2.15	0.00119	0.0242
Stores and Restaurants	3.92	0.00093	0.0092
Warehouses (excl. manufacturer owned)	2.74	0.00056	0.0183

Source: Navigant Analysis

F.4 Savings By Design Future Program Savings Potential

PG&E's SBD program savings potential are reported in Table F-8, Table F-9, and Table F-10. These tables show the remaining potential for 2013-2015 as well as the missed potential in past program cycles (2006-2012). Data from these tables are presented graphically in Figure F-1, Figure F-2, and Figure F-3. Focusing on future potential (2013-2015):

- The greatest electric savings (kWh) potential is in *Office and Bank Buildings* and *Stores and Restaurants*
- The greatest demand savings (kW) potential is in *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)*
- The greatest gas savings (therms) potential is in *Office and Bank Buildings* and *Hospitals and Other Health Treatment.*

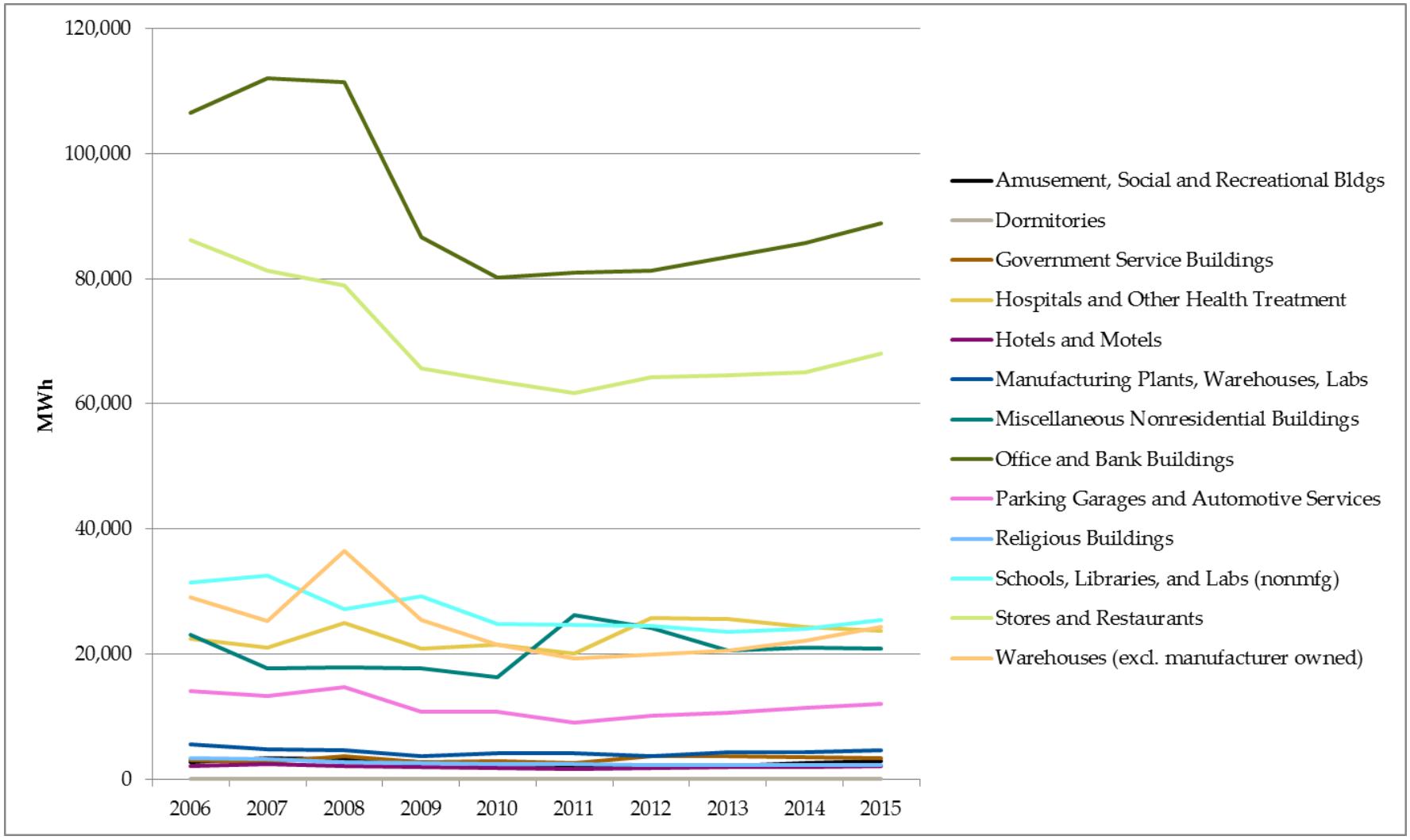
The overall trend of decreasing savings from 2006 to 2012 is due to decreasing new construction activity during the recession. The slight increase in savings potential from 2013 to 2015 reflects the projection that new construction activities will start to recover after the recession.

Table F-8: PG&E SBD Savings Potential, Historical and Future (MWh)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	2,728	3,333	3,234	2,781	2,401	2,201	2,043	2,050	2,539	2,806
Dormitories	0	0	0	0	0	0	0	0	0	0
Government Service Buildings	3,030	2,740	3,581	2,703	2,818	2,521	3,732	3,712	3,441	3,309
Hospitals and Other Health Treatment	22,434	21,075	25,021	20,902	21,441	20,047	25,730	25,636	24,363	23,746
Hotels and Motels	2,153	2,319	2,130	1,974	1,704	1,673	1,744	1,913	1,996	2,019
Manufacturing Plants, Warehouses, Labs	5,496	4,683	4,548	3,701	4,147	4,148	3,704	4,207	4,343	4,554
Miscellaneous Nonresidential Buildings	23,017	17,650	17,796	17,708	16,249	26,279	24,097	20,535	21,061	20,905
Office and Bank Buildings	106,569	111,975	111,465	86,693	80,087	80,883	81,222	83,475	85,691	88,896
Parking Garages and Automotive Services	14,107	13,313	14,674	10,789	10,812	9,009	10,093	10,659	11,343	11,955
Religious Buildings	3,273	3,209	2,763	2,573	2,390	2,442	2,163	2,180	2,301	2,177
Schools, Libraries, and Labs (nonmfg)	31,380	32,531	27,116	29,198	24,833	24,709	24,526	23,520	24,076	25,423
Stores and Restaurants	86,176	81,216	78,895	65,676	63,590	61,672	64,172	64,539	65,075	68,042
Warehouses (excl. manufacturer owned)	29,010	25,317	36,402	25,473	21,481	19,318	19,906	20,610	22,139	24,256
Total	**329,372**	**319,362**	**327,625**	**270,171**	**251,953**	**254,903**	**263,131**	**263,035**	**268,368**	**278,088**

Source: Navigant Analysis

Figure F-1: PG&E SBD Savings Potential, Historical and Future (MWh)



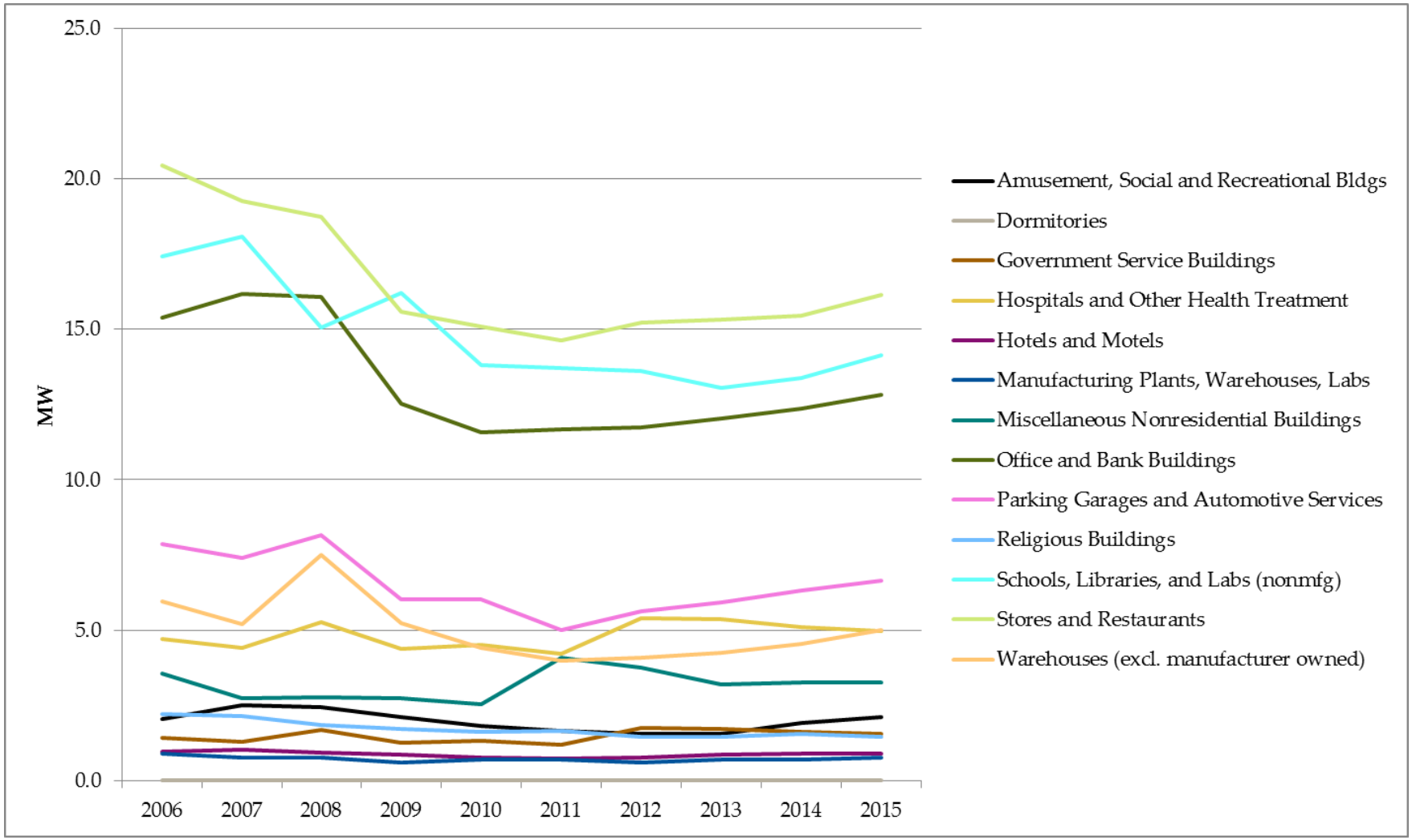
Source: Navigant Analysis

Table F-9: PG&E SBD Savings Potential, Historical and Future (MW)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	2.1	2.5	2.4	2.1	1.8	1.7	1.5	1.5	1.9	2.1
Dormitories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Service Buildings	1.4	1.3	1.7	1.3	1.3	1.2	1.7	1.7	1.6	1.5
Hospitals and Other Health Treatment	4.7	4.4	5.2	4.4	4.5	4.2	5.4	5.4	5.1	5.0
Hotels and Motels	1.0	1.0	0.9	0.9	0.8	0.7	0.8	0.8	0.9	0.9
Manufacturing Plants, Warehouses, Labs	0.9	0.8	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.7
Miscellaneous Nonresidential Buildings	3.6	2.7	2.8	2.7	2.5	4.1	3.7	3.2	3.3	3.2
Office and Bank Buildings	15.4	16.2	16.1	12.5	11.6	11.7	11.7	12.0	12.4	12.8
Parking Garages and Automotive Services	7.9	7.4	8.2	6.0	6.0	5.0	5.6	5.9	6.3	6.7
Religious Buildings	2.2	2.2	1.9	1.7	1.6	1.6	1.4	1.5	1.5	1.5
Schools, Libraries, and Labs (nonmfg)	17.4	18.1	15.1	16.2	13.8	13.7	13.6	13.1	13.4	14.1
Stores and Restaurants	20.5	19.3	18.7	15.6	15.1	14.6	15.2	15.3	15.4	16.1
Warehouses (excl. manufacturer owned)	6.0	5.2	7.5	5.2	4.4	4.0	4.1	4.2	4.6	5.0
Total	**82.9**	**81.0**	**81.2**	**69.3**	**64.1**	**63.2**	**65.5**	**65.4**	**67.1**	**69.7**

Source: Navigant Analysis

Figure F-2: PG&E SBD Savings Potential, Historical and Future (MW)



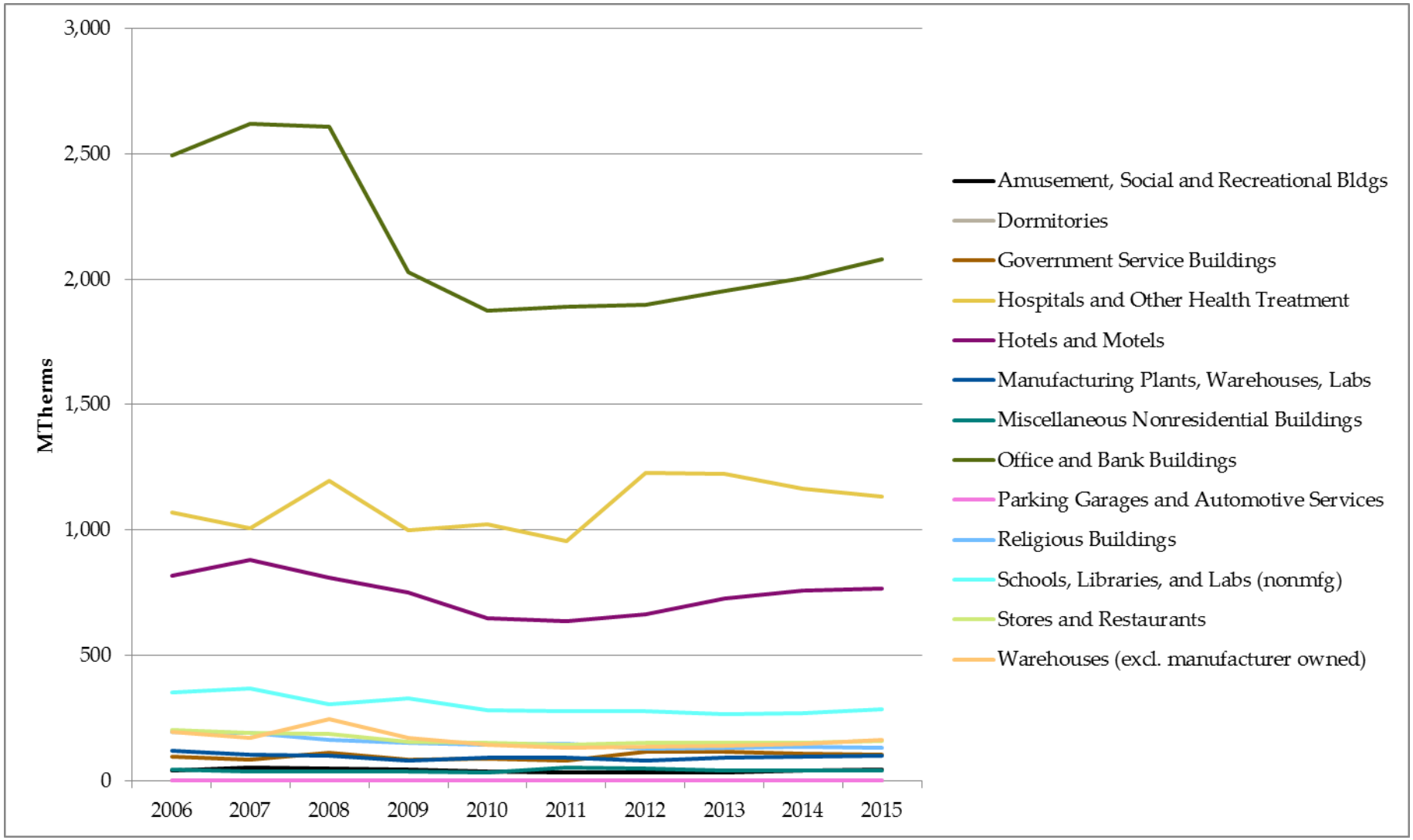
Source: Navigant Analysis

Table F-10: PG&E SBD Savings Potential, Historical and Future (MTherms)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	41	51	49	42	36	33	31	31	39	43
Dormitories	0	0	0	0	0	0	0	0	0	0
Government Service Buildings	94	85	111	84	87	78	116	115	107	103
Hospitals and Other Health Treatment	1,071	1,006	1,194	998	1,023	957	1,228	1,224	1,163	1,134
Hotels and Motels	819	882	810	751	648	636	663	728	759	768
Manufacturing Plants, Warehouses, Labs	121	103	100	81	91	91	81	92	95	100
Miscellaneous Nonresidential Buildings	46	35	35	35	32	52	48	41	42	41
Office and Bank Buildings	2,492	2,618	2,606	2,027	1,873	1,891	1,899	1,952	2,004	2,079
Parking Garages and Automotive Services	0	0	0	0	0	0	0	0	0	0
Religious Buildings	194	190	164	152	142	145	128	129	136	129
Schools, Libraries, and Labs (nonmfg)	353	366	305	328	279	278	276	264	271	286
Stores and Restaurants	202	190	185	154	149	144	150	151	152	159
Warehouses (excl. manufacturer owned)	194	170	244	171	144	129	133	138	148	162
Total	**5,626**	**5,695**	**5,803**	**4,823**	**4,505**	**4,436**	**4,754**	**4,865**	**4,916**	**5,003**

Source: Navigant Analysis

Figure F-3: PG&E SBD Savings Potential, Historical and Future (Mtherms)



Source: Navigant Analysis

Navigant combined the remaining potential into single metric which PG&E can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric, demand, and gas savings respectively that each building type contained. Next, Navigant averaged these percent values to come up with a composite value. Finally, buildings were ranked from high to low based on these composite values. The results are shown in Table F-11. Based on the ranking, *Office and Bank Buildings* and *Stores and Restaurants* are the top two building types with most savings potential; *Hospitals and Other Health Treatment* places in third.

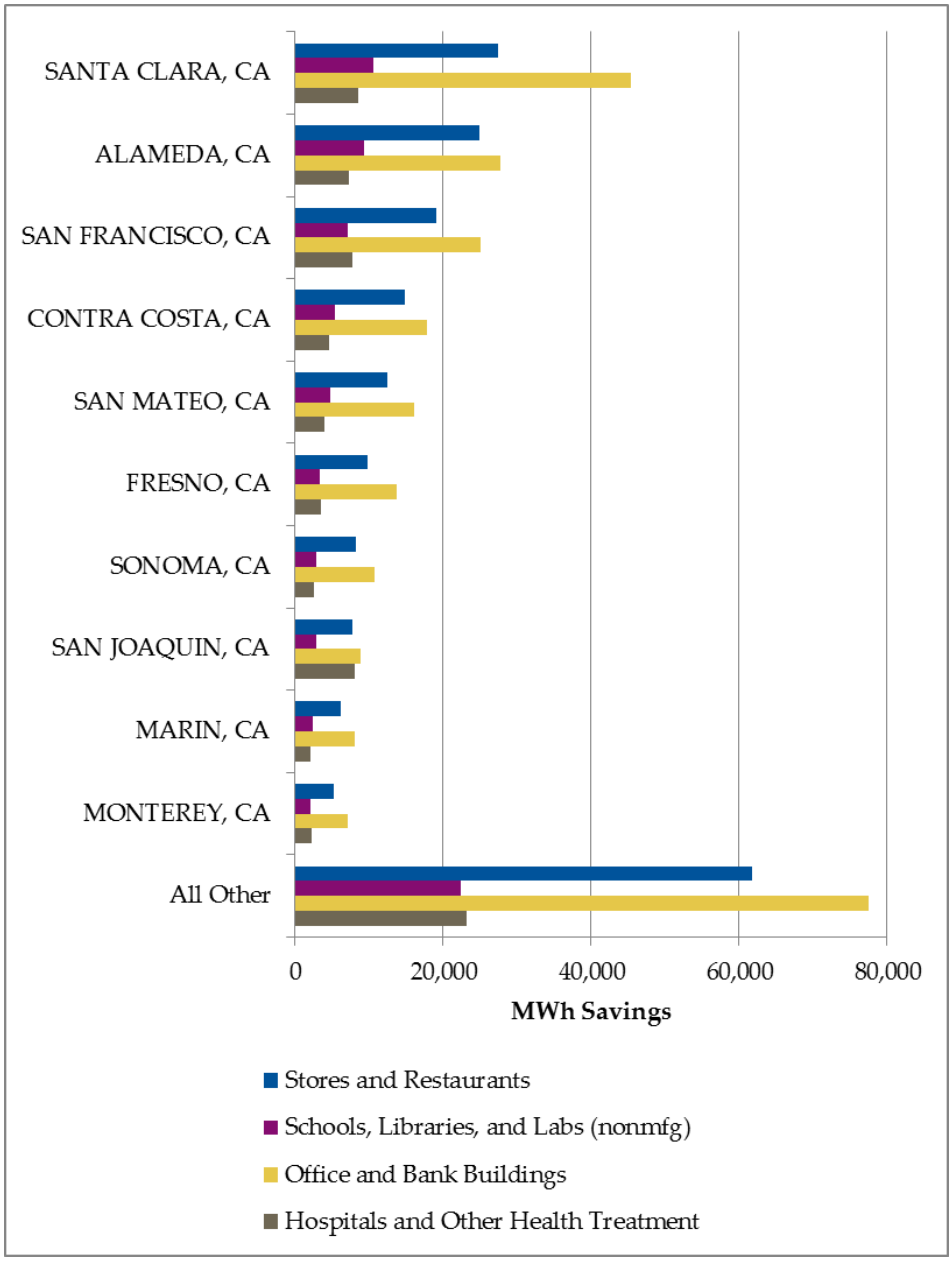
Table F-11: PG&E SBD Potential - Ranked Building Types

		2013-15 Remaining Potential			2013-15 Score (Percent of total future potential savings)			
Rank	*Building Type*	*MWh*	*MW*	*MTherm*	*MWh*	*MW*	*MTherm*	*Average Percent*
1	Office and Bank Buildings	254,857	37	5,959	32%	18%	41%	30%
2	Stores and Restaurants	194,689	46	456	24%	23%	3%	17%
3	Hospitals and Other Health Treatment	74,361	16	3,550	9%	8%	24%	14%
4	Schools, Libraries, and Labs (nonmfg)	71,673	40	806	9%	20%	5%	11%
5	Warehouses (excl. manufacturer owned)	64,889	13	435	8%	7%	3%	6%
6	Hotels and Motels	5,905	3	2,246	1%	1%	15%	6%
7	Miscellaneous Nonresidential Buildings	62,656	10	124	8%	5%	1%	5%
8	Parking Garages and Automotive Services	33,345	19	0	4%	9%	0%	4%
9	Government Service Buildings	10,593	5	328	1%	2%	2%	2%
10	Religious Buildings	6,782	5	402	1%	2%	3%	2%
11	Manufacturing Plants, Warehouses, Labs	12,893	2	283	2%	1%	2%	2%
12	Amusement, Social and Recreational Bldgs.	7,128	5	108	1%	3%	1%	1%
13	Dormitories	0	0	0	0%	0%	0%	0%

Source: Navigant Analysis

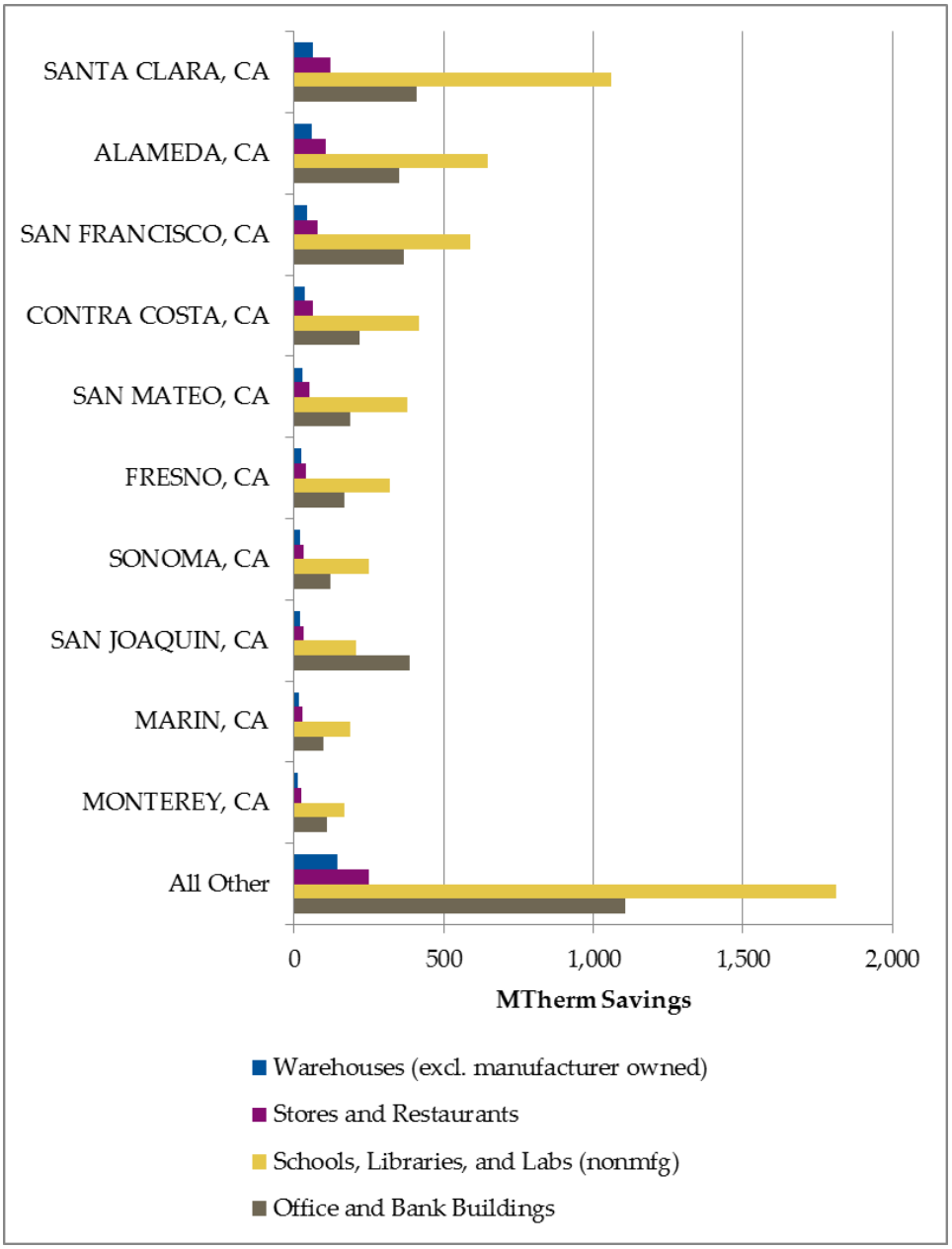
Navigant further presents information on the portion of future potential for the top four building types that reside in each county within the PG&E service territory. These results are illustrated in Figure F-4 and Figure F-5.

Figure F-4: PG&E SBD Potential of Top Four Building Types by County (MWh)



Source: Navigant Analysis

Figure F-5: PG&E SBD Potential of Top Four Building Types by County (MTherms)



Source: Navigant Analysis

F.5 Past Estimates of Market Penetration and Savings Potential

There are no previous studies of SBD market penetration or savings potential for SDG&E that cover a comparable time period as this analysis. Previous program tracking reports do contain the total savings and participation rate from 2000 to 2005. Those studies followed a different accounting methodology than this study; results are not easily comparable. Key points that differentiate previous program tracking reports from this study include:

- Program participants prior to 2006 were reported on the basis of applications (i.e., when a project started, not when it was completed.
- Past studies did not quantify the floor space of eligible existing building renovations but rather the number of buildings that filed a permit for renovations.
- Past studies did not forecast future program potential, limited data is available past 2005.

Appendix G. SDG&E Detailed Program Market Potential Results

This appendix provides a detailed discussion of SDG&E analysis and results.

G.1 Methodology and Data Sources

Analysis of SDG&E data followed the methodology outlined in *Section 1-Introduction & Methodology* with no deviations. Data was provided by SDG&E program managers containing the following key information for each SBD participant from 2006 to 2012:

- Program year
- Energy Savings (kWh, kW, and Therms)
- Square footage
- Building type
- Project type (new construction vs. existing building renovation)

The Building types provided by SDG&E did not match exactly to the Dodge building types. Navigant mapped each SDG&E building type classification to a Dodge building type and provided the mapping to SDG&E staff for review.

G.2 Program Market Penetration

SDG&E's SBD program market penetration varies by building type as listed in Table G-1. Historically the highest participation rates were achieved in *Dormitories* (65 percent) and *Parking Garages* (45 percent) while the lowest participation rates were observed in *Hotels and Motels* (1 percent) and *Warehouses* (3 percent).

Table G-1: SDG&E SBD Participation Rate by Building Type (2006-2012)

Building Type	Average Participation Rate
Amusement, Social and Recreational Bldgs.	10%
Dormitories	65%
Government Service Buildings	12%
Hospitals and Other Health Treatment	12%
Hotels and Motels	1%
Manufacturing Plants, Warehouses, Labs	19%
Miscellaneous Nonresidential Buildings	31%
Office and Bank Buildings	16%
Parking Garages and Automotive Services	40%
Religious Buildings	6%
Schools, Libraries, and Labs (nonmfg)	17%
Stores and Restaurants	6%
Warehouses (excl. manufacturer owned)	3%
All Building Types	**17%**

Source: Navigant Analysis

SDG&E's overall participation rate in SBD by year is documented in Table G-2. SDG&E participation in SBD increased from 2006 to 2008. Participation does not seem to follow a trend from 2009 to 2012

Table G-2: SDG&E SBD Participation Rate by Year for All Building Types

	2006	2007	2008	2009	2010	2011	2012
Participation Rate	6%	16%	16%	12%	26%	5%	41%

Source: Navigant Analysis

G.3 Historic Program Savings and Savings per Square Foot

SDG&E's SBD historic electric, demand, and gas savings by building type and by year are documented in Table G-3, and Table G-4, respectively. Five building types account for 77 percent of the historic electric savings (MWh) and 85 percent of the historic demand savings (MW): *Manufacturing Plants, Warehouses, Labs*; *Office and Bank Buildings*; *Parking Garages and Automotive Services*; Schools, *Libraries, and Labs (nonmfg)*; and *Stores and Restaurants*. Five building types account for 96 percent of the historic gas savings: *Dormitories*; *Manufacturing Plants, Warehouses, Labs*; *Miscellaneous Nonresidential Buildings*; *Schools, Libraries, and Labs (nonmfg)*; and *Warehouses (excl. manufacturer owned)*. Negative values reported in Table G-5 for gas savings represents interactive effects from electric efficiency measures that result in increased gas usage by a customer.

Table G-3: SDG&E SBD Savings Building Type and Year (MWh)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	0	48	0	22	294	0	866	**1,230**
Dormitories	0	133	167	252	1,931	485	3,055	**6,023**
Government Service Buildings	0	0	12	0	198	97	1,047	**1,354**
Hospitals and Other Health Treatment	0	18	57	614	2,058	114	4,358	**7,219**
Hotels and Motels	0	0	69	0	0	0	0	**69**
Manufacturing Plants, Warehouses, Labs	2,916	87	4,224	382	3,174	2,067	1,829	**14,679**
Miscellaneous Nonresidential Buildings	0	0	1,074	24	150	0	360	**1,608**
Office and Bank Buildings	459	2,042	1,867	2,623	3,638	256	1,656	**12,542**
Parking Garages and Automotive Services	1,449	3,780	2,601	1,711	3,925	475	3,114	**17,055**
Religious Buildings	0	0	164	0	62	0	178	**405**
Schools, Libraries, and Labs (nonmfg)	973	1,891	1,097	2,343	2,576	319	5,858	**15,057**
Stores and Restaurants	915	1,700	2,612	2,641	1,264	2,812	2,339	**14,283**
Warehouses (excl. manufacturer owned)	0	30	3,493	0	125	0	30	**3,679**
Total	**6,713**	**9,730**	**17,436**	**10,613**	**19,394**	**6,624**	**24,691**	**95,202**

Source: Navigant Analysis

Table G-4: SDG&E SBD Savings Building Type and Year (MW)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	0.00	0.02	0.00	0.02	0.17	0.00	0.26	0.47
Dormitories	0.00	0.02	0.06	0.06	0.08	0.16	0.59	0.97
Government Service Buildings	0.00	0.00	0.01	0.00	0.04	0.06	0.20	0.30
Hospitals and Other Health Treatment	0.00	0.01	0.02	0.04	0.53	0.09	0.64	1.34
Hotels and Motels	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
Manufacturing Plants, Warehouses, Labs	1.19	0.03	0.67	0.05	0.11	0.40	0.89	3.35
Miscellaneous Nonresidential Buildings	0.00	0.00	-0.15	0.02	0.05	0.00	0.04	-0.04
Office and Bank Buildings	0.16	0.69	0.65	1.19	1.37	0.39	0.44	4.88
Parking Garages and Automotive Services	0.21	0.57	0.38	0.29	0.64	0.06	0.43	2.58
Religious Buildings	0.00	0.00	0.09	0.00	0.04	0.00	0.06	0.19
Schools, Libraries, and Labs (nonmfg)	0.18	0.80	0.56	1.45	1.82	0.24	2.94	7.98
Stores and Restaurants	0.26	0.48	0.90	0.67	0.24	0.44	0.43	3.43
Warehouses (excl. manufacturer owned)	0.00	0.01	0.57	0.00	0.06	0.00	0.01	0.66
Total	**2.00**	**2.62**	**3.77**	**3.79**	**5.17**	**1.84**	**6.92**	**26.12**

Source: Navigant Analysis

Table G-5: SDG&E SBD Savings Building Type and Year (MTherms)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	0.0	0.0	0.0	0.2	1.8	0.0	44.4	46.4
Dormitories	0.0	0.7	3.8	0.1	27.6	4.8	75.5	112.5
Government Service Buildings	0.0	0.0	0.0	0.0	6.1	1.4	13.8	21.2
Hospitals and Other Health Treatment	0.0	0.3	0.6	9.7	3.7	0.2	-10.8	3.6
Hotels and Motels	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1
Manufacturing Plants, Warehouses, Labs	135.6	0.0	40.0	0.0	0.1	143.7	24.0	343.2
Miscellaneous Nonresidential Buildings	0.0	0.0	0.8	0.9	6.7	0.0	252.9	261.2
Office and Bank Buildings	0.4	3.5	3.2	-7.5	4.7	0.0	0.0	4.3
Parking Garages and Automotive Services	0.0	-0.3	0.0	0.0	1.5	0.0	0.0	1.2
Religious Buildings	0.0	0.0	1.0	0.0	0.1	0.0	0.1	1.2
Schools, Libraries, and Labs (nonmfg)	58.2	6.0	6.9	4.9	22.2	2.3	45.9	146.4
Stores and Restaurants	-0.9	-21.8	-20.2	-12.7	-2.6	35.0	6.2	-17.0
Warehouses (excl. manufacturer owned)	0.0	0.0	0.2	0.0	708.7	0.0	0.0	708.9
Total	**193.3**	**-11.6**	**37.3**	**-4.4**	**780.6**	**187.2**	**451.9**	**1,634.3**

Source: Navigant Analysis

Navigant subsequently calculated the average savings per square foot ("Participant Savings" in Figure 1-1) for each building type, reported in Table G-6. This value is used to forecast SBD Program Savings Potential. Several projects achieving significant gas savings were observed in the SDG&E data set. These account for the large gas savings in Warehouses (excl. manufacturer owned) in 2010 and Miscellaneous Nonresidential Buildings in 2012 as seen in Table G-6. These two projects were excluded from the calculation of average savings per square foot; including them would have skewed potential savings to be higher than normal.

Table G-6: SDG&E SBD Average Savings per Square Foot (2006-2012)

Building Type	kWh/Sqft	kW/Sqft	Therms/sqft
Amusement, Social and Recreational Bldgs.	3.17	0.00122	0.1197
Dormitories	1.91	0.00031	0.0357
Government Service Buildings	2.68	0.00060	0.0420
Hospitals and Other Health Treatment	5.43	0.00101	0.0027
Hotels and Motels	0.41	0.00007	0.0065
Manufacturing Plants, Warehouses, Labs	6.83	0.00156	0.1597
Miscellaneous Nonresidential Buildings	2.64	-0.00007	0.0386*
Office and Bank Buildings	1.62	0.00063	0.0006
Parking Garages and Automotive Services	1.32	0.00020	0.0001
Religious Buildings	3.08	0.00146	0.0094
Schools, Libraries, and Labs (nonmfg)	2.92	0.00155	0.0284
Stores and Restaurants	5.34	0.00128	-0.0064
Warehouses (excl. manufacturer owned)	9.96	0.00178	0.0014**

Source: Navigant Analysis
*Excludes an outlier project. Including the outlier would result in a value of 0.43 therms/sqft.
**Excludes an outlier project. Including the outlier would result in a value of 1.91 therms/sqft.

G.4 Savings By Design Future Program Savings Potential

SDG&E's SBD future program savings potential are reported in Table G-7, Table G-8, and Table G-9. These tables show the remaining potential for 2013 through 2015 as well as the missed potential in past program cycles (2006-2012). Data from these tables are presented graphically in Figure G-1, Figure G-2, and Figure G-3. Focusing on future potential (2013-2015):

- The greatest electric savings (MWh) potential is in *Stores and Restaurants* and *Warehouses (excl. manufacturer owned)*.
- The greatest demand savings (MW) potential is in *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)*.
- The greatest gas savings (Mtherms) potential is in *Manufacturing Plants, Warehouses, Labs* and *Miscellaneous Nonresidential Buildings*.

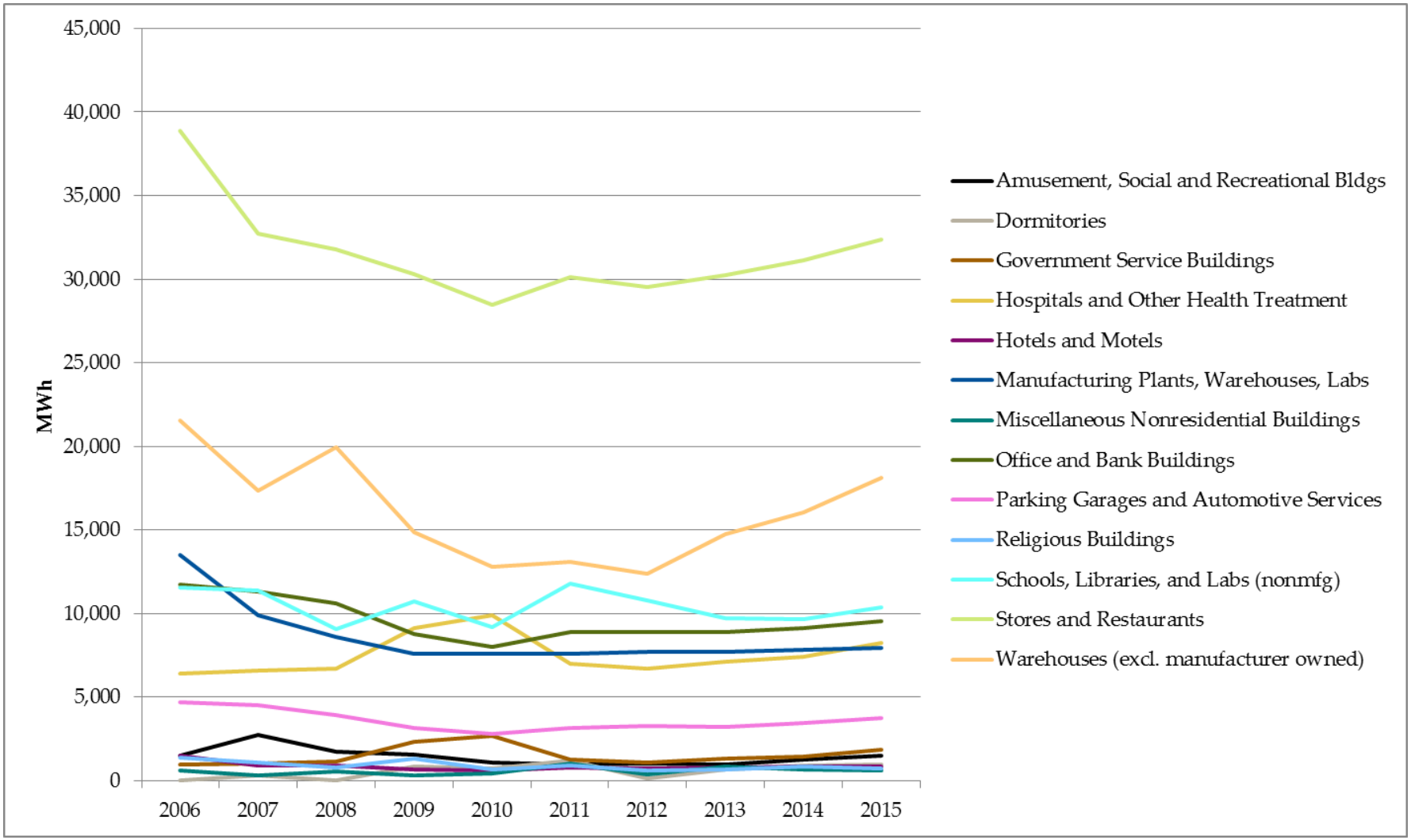
The overall trend of decreasing savings from 2006 – 2012 is due to decreasing new construction activity during the recession. The slight increase in savings potential from 2013 – 2015 reflects the projection that new construction activities will start to recover after the recession.

Table G-7: SDG&E SBD Savings Potential, Historical and Future (MWh)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	1,501	2,760	1,723	1,538	1,054	985	1,042	932	1,254	1,513
Dormitories	14	317	21	822	717	1,206	158	656	893	975
Government Service Buildings	942	1,041	1,105	2,316	2,670	1,245	1,093	1,293	1,442	1,862
Hospitals and Other Health Treatment	6,376	6,575	6,704	9,147	9,862	6,987	6,681	7,083	7,385	8,232
Hotels and Motels	1,478	873	903	689	604	781	698	782	816	855
Manufacturing Plants, Warehouses, Labs	13,498	9,890	8,577	7,597	7,594	7,594	7,688	7,713	7,802	7,934
Miscellaneous Nonresidential Buildings	588	302	562	305	443	1,017	374	831	640	611
Office and Bank Buildings	11,741	11,334	10,617	8,742	8,012	8,858	8,876	8,893	9,124	9,523
Parking Garages and Automotive Services	4,688	4,482	3,896	3,168	2,790	3,144	3,241	3,209	3,457	3,762
Religious Buildings	1,365	1,076	767	1,330	668	886	606	633	819	722
Schools, Libraries, and Labs (nonmfg)	11,567	11,352	9,068	10,735	9,164	11,757	10,800	9,683	9,630	10,341
Stores and Restaurants	38,899	32,745	31,775	30,295	28,445	30,140	29,549	30,268	31,113	32,361
Warehouses (excl. manufacturer owned)	21,558	17,342	19,928	14,882	12,803	13,088	12,362	14,740	16,058	18,137
Total	**114,216**	**100,088**	**95,645**	**91,567**	**84,827**	**87,689**	**83,166**	**86,715**	**90,434**	**96,829**

Source: Navigant Analysis

Figure 6-20: SDG&E SBD Savings Potential, Historical and Future (MWh)



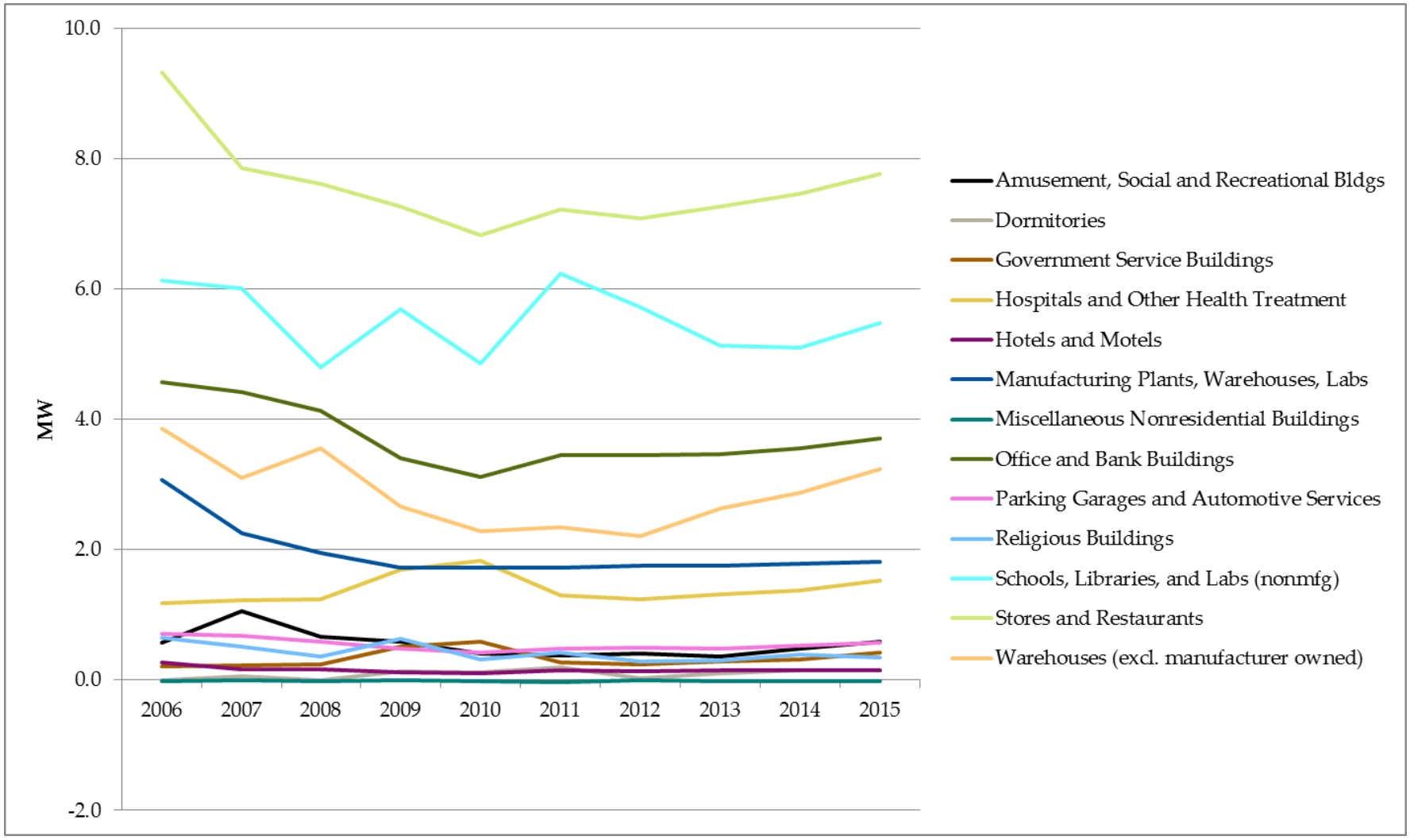
Source: Navigant Analysis

Table G-8: SDG&E SBD Savings Potential, Historical and Future (MW)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	0.6	1.1	0.7	0.6	0.4	0.4	0.4	0.4	0.5	0.6
Dormitories	0.0	0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.2
Government Service Buildings	0.2	0.2	0.2	0.5	0.6	0.3	0.2	0.3	0.3	0.4
Hospitals and Other Health Treatment	1.2	1.2	1.2	1.7	1.8	1.3	1.2	1.3	1.4	1.5
Hotels and Motels	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Manufacturing Plants, Warehouses, Labs	3.1	2.3	2.0	1.7	1.7	1.7	1.8	1.8	1.8	1.8
Miscellaneous Nonresidential Buildings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Office and Bank Buildings	4.6	4.4	4.1	3.4	3.1	3.5	3.5	3.5	3.6	3.7
Parking Garages and Automotive Services	0.7	0.7	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.6
Religious Buildings	0.6	0.5	0.4	0.6	0.3	0.4	0.3	0.3	0.4	0.3
Schools, Libraries, and Labs (nonmfg)	6.1	6.0	4.8	5.7	4.9	6.2	5.7	5.1	5.1	5.5
Stores and Restaurants	9.3	7.9	7.6	7.3	6.8	7.2	7.1	7.3	7.5	7.8
Warehouses (excl. manufacturer owned)	3.9	3.1	3.6	2.7	2.3	2.3	2.2	2.6	2.9	3.2
Total	**30.6**	**27.5**	**25.3**	**24.9**	**22.6**	**24.1**	**23.0**	**23.2**	**24.1**	**25.7**

Source: Navigant Analysis

Figure 6-21: SDG&E SBD Savings Potential, Historical and Future (MW)



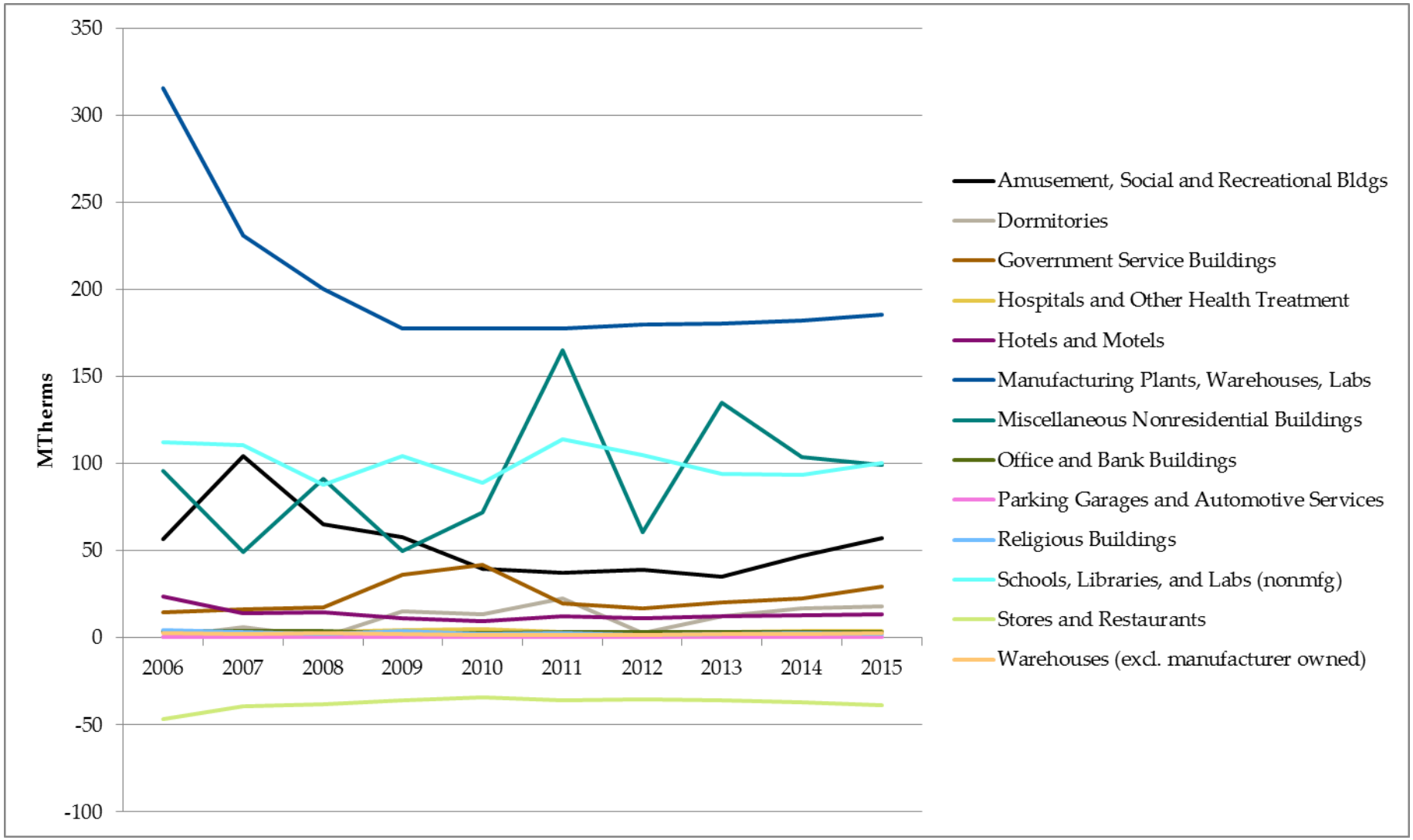
Source: Navigant Analysis

Table G-9: SDG&E SBD Savings Potential, Historical and Future (MTherms)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	57	104	65	58	40	37	39	35	47	57
Dormitories	0	6	0	15	13	23	3	12	17	18
Government Service Buildings	15	16	17	36	42	20	17	20	23	29
Hospitals and Other Health Treatment	3	3	3	5	5	3	3	4	4	4
Hotels and Motels	24	14	14	11	10	12	11	12	13	14
Manufacturing Plants, Warehouses, Labs	316	231	201	178	178	178	180	180	182	186
Miscellaneous Nonresidential Buildings	96	49	91	50	72	165	61	135	104	99
Office and Bank Buildings	4	4	4	3	3	3	3	3	3	3
Parking Garages and Automotive Services	0	0	0	0	0	0	0	0	0	0
Religious Buildings	4	3	2	4	2	3	2	2	3	2
Schools, Libraries, and Labs (nonmfg)	112	110	88	104	89	114	105	94	94	101
Stores and Restaurants	-46	-39	-38	-36	-34	-36	-35	-36	-37	-39
Warehouses (excl. manufacturer owned)	3	2	3	2	2	2	2	2	2	3
Total	**587**	**505**	**452**	**430**	**421**	**524**	**391**	**464**	**454**	**477**

Source: Navigant Analysis

Figure 6-22: SDG&E SBD Savings Potential, Historical and Future (MTherms)



Source: Navigant Analysis

Navigant combined the remaining potential into single metric which SDG&E can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric, demand, and gas savings respectively that each building type contained. Next, Navigant averaged these percent values to come up with a composite value. Finally, buildings were ranked from high to low based on these composite values. The results are shown in Table G-10. Based on the ranking, *Manufacturing Plants, Warehouses, Labs* and *Schools, Libraries, and Labs (nonmfg)* are the top two building types with greatest savings potential; *Stores and Restaurants* rank third.

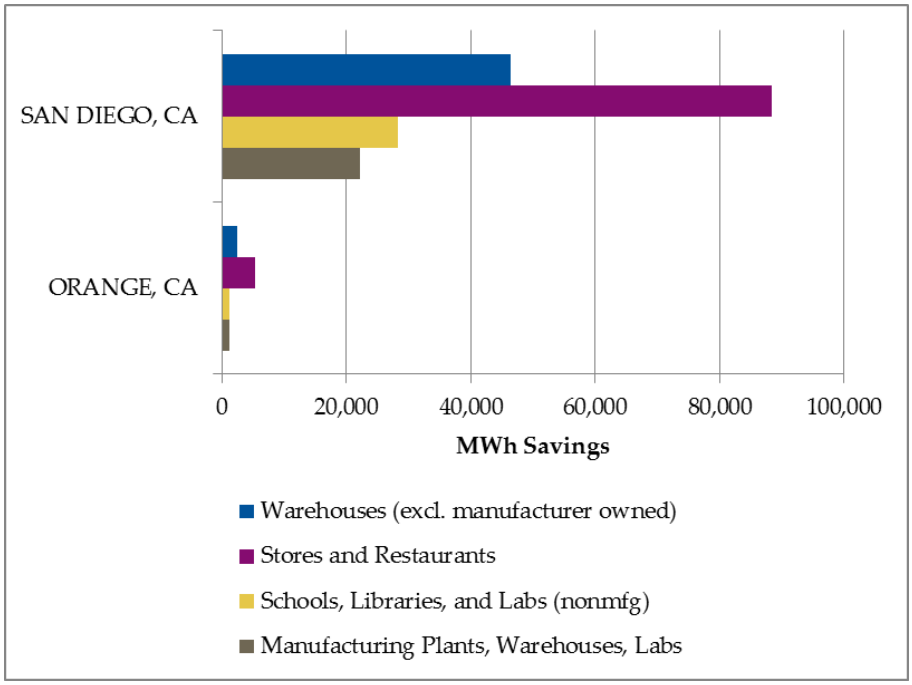
Table G-10: SDG&E SBD Potential - Ranked Building Types

		2013-15 Remaining Potential			2013-15 Score (Percent of total future potential savings)			
Rank	**Building Type**	**MWh**	**MW**	**MTherm**	**MWh**	**MW**	**MTherm**	**Average Percent**
1	Manufacturing Plants, Warehouses, Labs	23,317	5	545	9%	7%	51%	**23%**
2	Schools, Libraries, and Labs (nonmfg)	28,943	15	281	11%	21%	27%	**20%**
3	Stores and Restaurants	92,493	22	-110	35%	31%	-10%	**18%**
4	Warehouses (excl. manufacturer owned)	46,856	8	6	18%	12%	1%	**10%**
5	Office and Bank Buildings	27,142	11	9	10%	15%	1%	**9%**
6	Amusement, Social and Recreational Bldgs.	3,440	1	130	1%	2%	12%	**5%**
7	Hospitals and Other Health Treatment	21,853	4	11	8%	6%	1%	**5%**
8	Government Service Buildings	4,177	1	66	2%	1%	6%	**3%**
9	Parking Garages and Automotive Services	10,123	2	1	4%	2%	0%	**2%**
10	Dormitories	2,442	0	46	1%	1%	4%	**2%**
11	Hotels and Motels	2,413	0	38	1%	1%	4%	**2%**
12	Miscellaneous Nonresidential Buildings	2,112	0	31	1%	0%	3%	**1%**
13	Religious Buildings	2,272	1	7	1%	2%	1%	**1%**

Source: Navigant Analysis

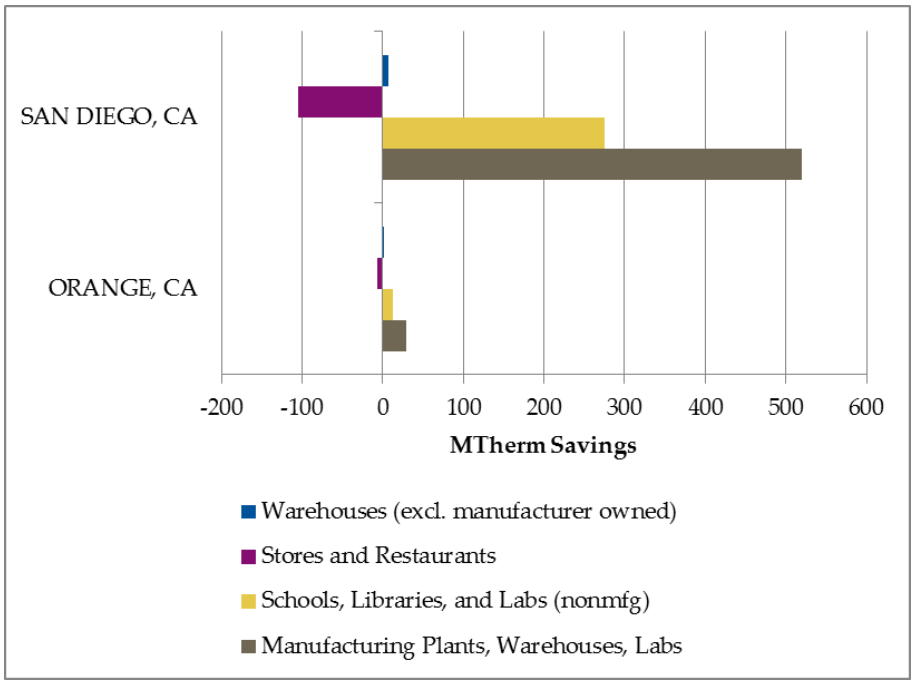
Navigant further presents information on the portion of potential for the top four building types that reside in each county with SDG&E service territory. These results are illustrated in Figure G-4 and Figure G-5.

Figure 6-23: SDG&E SBD Potential of Top Four Building Types by County (MWh)



Source: Navigant Analysis

Figure 6-24: SDG&E SBD Potential of Top Four Building Types by County (Mtherms)



Source: Navigant Analysis

G.5 Past Estimates of Market Penetration and Savings Potential

There are no previous studies of SBD market penetration or savings potential for SDG&E that cover a comparable time period of analysis as this analysis. Previous program tracking reports do contain the total savings and participation rate from 2000 through 2005. Those studies followed a different accounting methodology than this study; results are not easily comparable. Key points that differentiate previous program tracking reports from this study include:

- Program participants prior to 2006 were reported on the basis of applications (i.e., when a project started, not when it was completed.
- Past studies did not quantify the floor space of eligible existing building renovations but rather the number of buildings that filed a permit for renovations.
- Past studies did not forecast future program potential, limited data is available past 2005.

Appendix H. SCE Detailed Program Market Potential Results

This appendix provides a detailed discussion of SCE analysis and results.

H.1 Methodology and Data Sources

Analysis of SCE data followed the methodology outlined in *Section **1-Introduction & Methodology*** with some slight modifications to address data gaps (described further below).

Data was provided by SCE program managers containing the following key information for each SBD participant from 2006 to 2012:

- Program year
- Energy Savings (kWh, kW, and Therms)
- Square footage
- Building type

The building types provided by SCE did not match exactly to the Dodge building types. Navigant mapped each SCE building type classification to a Dodge building type.

SCE provided data extracts from two different internal databases. SCE staff indicated participant data was transitioned from one database system to another during the period for which data was requested. The two data sets contained participant data from 2006 through 2011 and from 2010 through 2012. The dataset containing 2006 to 2011 was only used to extract data from 2006 to 2009 as the 2010 to 2012 data set was deemed more accurate for recent program years.

SCE data contained several data gaps related to building type and square footage:

1. 87 percent of participants (based on total kWh savings) from program years 2006 to 2009 had a square footage value populated, the rest of participants were missing data.
2. 81 percent of participants (based on total kWh savings) from program years 2006 to 2009 had both a have a square footage and building type value populated, the rest of participants are missing either one or both data points.
3. 38 percent of participants (based on total kWh savings) from program years 2010 to 2012 had a square footage value populated; however all participants had an associated building type.
4. SCE staff informed Navigant that the 2010 to 2012 data set listed multiple line items for the same participant (itemizing energy savings from various end uses). However, no common key for a unique project existed within the database. It was therefore, not possible to indicate the total savings per participant.

Navigant undertook a process to fill in the missing data for square footage and building types to be able to use the SCE data in this analysis. This methodology is summarized below.

1. **Calculate Savings per Square Foot:** Savings per square foot by building type were calculated for the 81 percent of participants that had both square footage and building type data populated.

This was calculated as a single value across all program years (2006 – 2009) for each building type.

2. **Estimate Square Footage Where Possible for 2006-2009 Participants**. For participants from 2006 to 2009 that listed a building type but were missing square footage, Navigant used the average savings per square foot calculated in step 1 and the participant savings to estimate the square footage of the participant.
3. **Distribute Data for Remaining Unknown Building Types**. After conducting step 2, a subset of 2006 to 2009 participants remained that had neither building type nor square footage data populated. The savings for these participants were added together as a total savings value; a total square footage value was calculated using the same process as step 2 using total savings. The total savings and square footage was then distributed to each building type based on the ratio of savings and square footage data from known building types.
4. **Estimate Square Footage for 2010 to 2012 Participants**. Because there was no common identifier for unique participants, Navigant could only rely on energy savings and building type data from 2010 to 2012 as those fields were fully populated. There was no way to associate the total energy savings for each participant with a square footage value for each participant. Navigant added the total savings for each building type in each year. The total energy savings was combined with the savings per square foot (calculated in step 2) to estimate the total square footage of participants for each building type.

The above steps provided a total savings and square footage value by building type and program year that could then be used in the subsequent SCE analysis.

H.2 Program Market Penetration

SCE's SBD program market penetration varies by building type as listed in Table H-1. Historically the highest participation rates were achieved in *Manufacturing Plants, Warehouses, Labs* (37 percent), *Miscellaneous Nonresidential Buildings* (34 percent) and *Warehouses* (25 percent) while the lowest participation rates were observed in *Dormitories* (0 percent), *Parking Garages and Automotive Services* (0 percent) and *Religious Buildings* (0 percent).

Table H-1: SCE SBD Participation Rate by Building Type, 2006-2012

Building Type	Average Participation Rate
Amusement, Social and Recreational Bldgs.	1%
Dormitories	0%
Government Service Buildings	1%
Hospitals and Other Health Treatment	10%
Hotels and Motels	7%
Manufacturing Plants, Warehouses, Labs	37%
Miscellaneous Nonresidential Buildings	34%
Office and Bank Buildings	17%
Parking Garages and Automotive Services	0%
Religious Buildings	0%
Schools, Libraries, and Labs (nonmfg)	12%
Stores and Restaurants	12%
Warehouses (excl. manufacturer owned)	25%
All Building Types	**13%**

Source: Navigant Analysis

SCE's overall participation rate in SBD by year is documented in Table H-2. SCE customer participation in SBD generally remained flat with minor changes from 2006 through 2010. Participation rate decreased in the following years.

Table H-2: SCE SBD Participation Rate by Year for All Building Types

9	2006	2007	2008	2009	2010	2011	2012
Participation Rate	14%	12%	14%	15%	16%	12%	9%

Source: Navigant Analysis

H.3 Historic Program Savings and Savings per Square Foot

SCE's SBD historic electric and demand by building type and by year are documented in Table H-3 and Table H-4. Five building types account for 86 percent of the historic electric savings (MWh) and 91 percent of the historic demand savings (MW): *Manufacturing Plants, Warehouses, Labs*; *Office and Bank Buildings*; *Schools, Libraries, and Labs (nonmfg)*; *Stores and Restaurants*; and *Warehouses (excl. manufacturer owned)*.

Table H-3: SCE SBD Savings Building Type and Year (MWh)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	40	2	14	0	48	0	0	**104**
Dormitories	0	0	0	0	0	0	0	**0**
Government Service Buildings	28	85	39	62	0	0	0	**214**
Hospitals and Other Health Treatment	1,554	1,674	2,727	3,531	4,379	601	1,540	**16,006**
Hotels and Motels	1,814	537	6,550	737	125	1,239	482	**11,483**
Manufacturing Plants, Warehouses, Labs	6,708	13,165	3,415	1,817	8,457	11,746	11,328	**56,636**
Miscellaneous Nonresidential Buildings	762	294	60	4,271	9,520	3,326	9,065	**27,299**
Office and Bank Buildings	6,176	5,913	2,405	16,034	13,790	4,751	1,190	**50,259**
Parking Garages and Automotive Services	6	2	30	9	0	0	0	**47**
Religious Buildings	0	0	0	0	0	0	0	**0**
Schools, Libraries, and Labs (nonmfg)	8,513	3,437	6,819	10,085	3,336	3,961	2,142	**38,293**
Stores and Restaurants	15,057	23,745	18,776	9,936	7,432	9,243	8,892	**93,082**
Warehouses (excl. manufacturer owned)	16,962	21,676	19,299	20,181	15,594	12,285	5,834	**111,831**
Total	**57,621**	**70,530**	**60,135**	**66,664**	**62,682**	**47,151**	**40,472**	**405,254**

Source: Navigant Analysis

Table H-4: SCE SBD Savings Building Type and Year (MW)

Dodge Building Type	2006	2007	2008	2009	2010	2011	2012	Total
Amusement, Social and Recreational Bldgs.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Dormitories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Government Service Buildings	0.0	0.1	0.0	0.0	0.0	0.0	0.0	**0.1**
Hospitals and Other Health Treatment	0.1	0.2	0.4	1.0	0.8	0.1	0.4	**3.1**
Hotels and Motels	0.6	0.2	0.3	0.1	0.0	0.2	0.2	**1.6**
Manufacturing Plants, Warehouses, Labs	0.5	1.6	0.6	0.3	1.8	1.1	1.6	**7.6**
Miscellaneous Nonresidential Buildings	0.1	0.0	0.0	0.5	1.3	0.5	0.7	**3.0**
Office and Bank Buildings	1.0	1.9	0.7	6.0	3.0	1.3	0.6	**14.6**
Parking Garages and Automotive Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Religious Buildings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Schools, Libraries, and Labs (nonmfg)	3.7	2.0	2.3	3.6	2.1	2.2	1.0	**16.8**
Stores and Restaurants	2.7	5.6	3.8	2.4	1.4	1.8	1.4	**19.2**
Warehouses (excl. manufacturer owned)	2.0	3.2	3.4	3.1	2.3	1.6	0.8	**16.4**
Total	**10.8**	**14.9**	**11.6**	**17.1**	**12.7**	**8.7**	**6.7**	**82.4**

Source: Navigant Analysis

Navigant subsequently calculated the average savings per square foot ("Participant Savings" in Figure 1-1) for each building type, reported in Table H-5. This value is used to forecast SBD Future Program Savings Potential.

Table H-5: SCE SBD Average Savings per Square Foot (2006-2012)

Building Type	kWh/Sqft	kW/Sqft	Therms/sqft
Amusement, Social and Recreational Bldgs.	0.90	0.00037	0
Dormitories	0.00	0.00000	0
Government Service Buildings	2.50	0.00138	0
Hospitals and Other Health Treatment	2.29	0.00044	0
Hotels and Motels	2.40	0.00033	0
Manufacturing Plants, Warehouses, Labs	6.11	0.00082	0
Miscellaneous Nonresidential Buildings	10.37	0.00113	0
Office and Bank Buildings	3.25	0.00095	0
Parking Garages and Automotive Services	0.85	0.00027	0
Religious Buildings	0.00	0.00000	0
Schools, Libraries, and Labs (nonmfg)	2.67	0.00117	0
Stores and Restaurants	4.43	0.00091	0
Warehouses (excl. manufacturer owned)	2.75	0.00040	0

Source: Navigant Analysis

H.4 Savings By Design Future Program Savings Potential

SCE's SBD future program savings potentials are reported in Table H-6 and Table H-7. These tables show the future potential for 2013 to 2015 as well as the missed potential in past program cycles (2006-2012). Data from these tables are presented graphically in Figure H-1 and Figure H-2. Focusing on future potential (2013-2015):

- The greatest electric savings (kWh) potential is in *Stores and Restaurants* and *Warehouses (excl. manufacturer owned)*
- The greatest demand savings (kW) potential is in *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)*

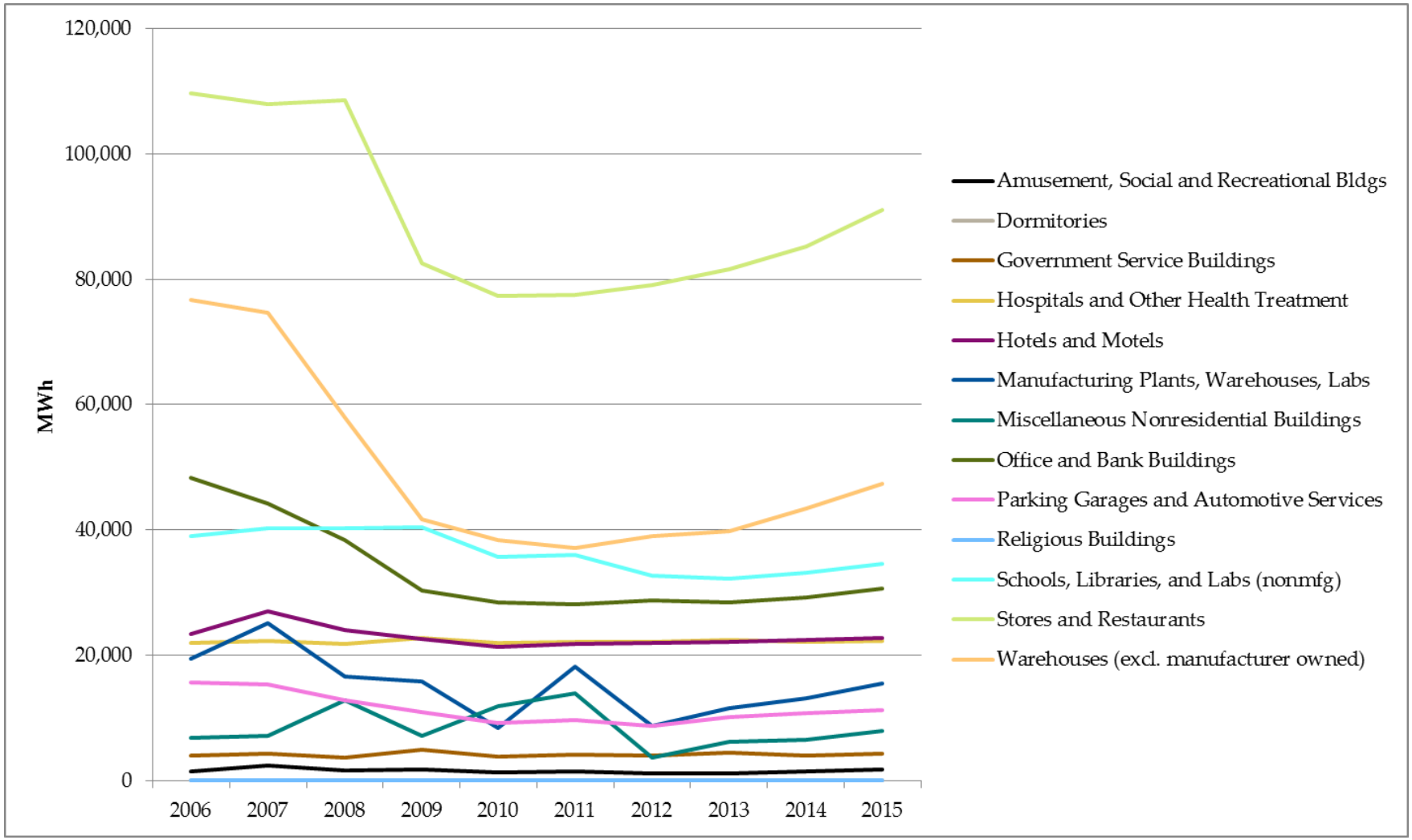
The overall trend of decreasing savings from 2006 to 2012 is due to decreasing new construction activity during the recession. The slight increase in savings potential from 2013 through 2015 reflects the projection that new construction activities will start to recover after the recession.

Table H-6: SCE SBD Savings Potential, Historical and Future (MWh)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	1,463	2,439	1,596	1,742	1,214	1,486	1,099	1,173	1,501	1,835
Dormitories	0	0	0	0	0	0	0	0	0	0
Government Service Buildings	3,931	4,258	3,724	4,869	3,873	4,085	4,043	4,446	4,021	4,343
Hospitals and Other Health Treatment	21,975	22,254	21,799	22,775	21,926	22,107	22,071	22,414	22,052	22,326
Hotels and Motels	23,401	26,925	24,037	22,653	21,386	21,790	21,959	22,151	22,442	22,690
Manufacturing Plants, Warehouses, Labs	19,491	25,061	16,541	15,725	8,428	18,095	8,654	11,551	13,066	15,459
Miscellaneous Nonresidential Buildings	6,836	7,109	12,879	7,070	11,814	13,846	3,696	6,147	6,510	7,837
Office and Bank Buildings	48,269	44,199	38,400	30,384	28,446	28,047	28,680	28,430	29,244	30,578
Parking Garages and Automotive Services	15,633	15,375	12,818	10,882	9,160	9,656	8,699	10,050	10,685	11,186
Religious Buildings	0	0	0	0	0	0	0	0	0	0
Schools, Libraries, and Labs (nonmfg)	38,981	40,229	40,180	40,343	35,634	36,060	32,695	32,131	33,131	34,643
Stores and Restaurants	109,590	107,878	108,560	82,528	77,380	77,487	79,102	81,518	85,242	91,091
Warehouses (excl. manufacturer owned)	76,754	74,564	57,924	41,703	38,334	37,130	38,919	39,839	43,450	47,395
Total	**366,324**	**370,292**	**338,458**	**280,673**	**257,595**	**269,789**	**249,617**	**259,850**	**271,345**	**289,383**

Source: Navigant Analysis

Figure 6-25: SCE SBD Savings Potential, Historical and Future (MWh)



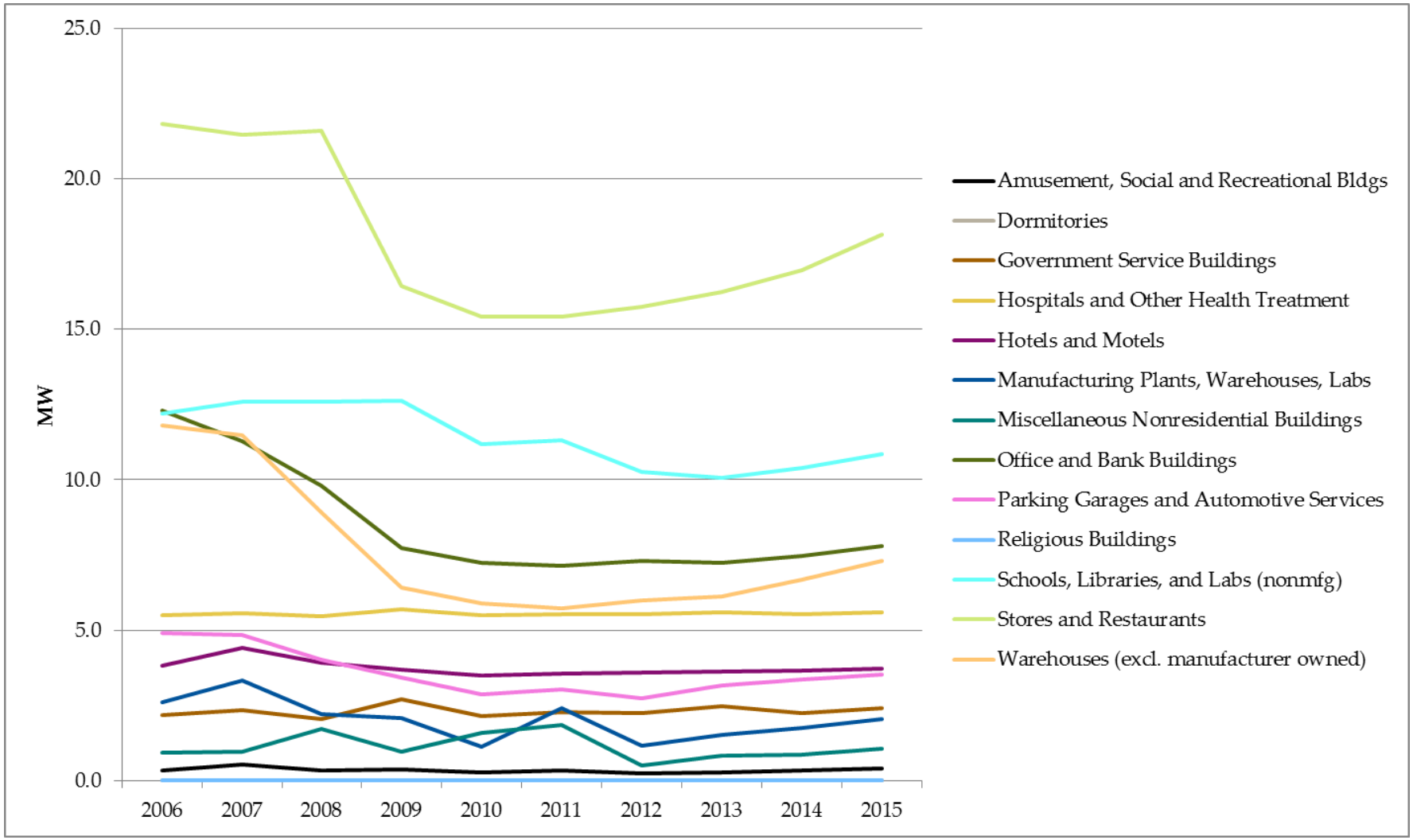
Source: Navigant Analysis

Table H-7: SCE SBD Savings Potential, Historical and Future (MW)

Building Type	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Amusement, Social and Recreational Bldgs.	0.3	0.5	0.3	0.4	0.3	0.3	0.2	0.3	0.3	0.4
Dormitories	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Service Buildings	2.2	2.4	2.1	2.7	2.1	2.3	2.2	2.5	2.2	2.4
Hospitals and Other Health Treatment	5.5	5.6	5.5	5.7	5.5	5.5	5.5	5.6	5.5	5.6
Hotels and Motels	3.8	4.4	3.9	3.7	3.5	3.6	3.6	3.6	3.7	3.7
Manufacturing Plants, Warehouses, Labs	2.6	3.3	2.2	2.1	1.1	2.4	1.1	1.5	1.7	2.1
Miscellaneous Nonresidential Buildings	0.9	1.0	1.7	0.9	1.6	1.9	0.5	0.8	0.9	1.1
Office and Bank Buildings	12.3	11.3	9.8	7.7	7.3	7.1	7.3	7.2	7.5	7.8
Parking Garages and Automotive Services	4.9	4.8	4.0	3.4	2.9	3.0	2.7	3.2	3.4	3.5
Religious Buildings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schools, Libraries, and Labs (nonmfg)	12.2	12.6	12.6	12.6	11.2	11.3	10.2	10.1	10.4	10.9
Stores and Restaurants	21.8	21.5	21.6	16.4	15.4	15.4	15.7	16.2	17.0	18.1
Warehouses (excl. manufacturer owned)	11.8	11.5	8.9	6.4	5.9	5.7	6.0	6.1	6.7	7.3
Total	**78.4**	**78.8**	**72.6**	**62.2**	**56.7**	**58.5**	**55.2**	**57.1**	**59.2**	**62.8**

Source: Navigant Analysis

Figure 6-26: SCE SBD Savings Potential, Historical and Future (MW)



Source: Navigant Analysis

Navigant combined the future potential into single metric which SCE can use to prioritize the top building segments to pursue in the next program cycle. First, Navigant calculated the percent of total electric and demand savings respectively that each building type contained. Next, Navigant averaged these percent values to come up with a composite value. Finally, buildings were ranked from high to low based on this composite value. The results are shown in Table H-8. Based on the ranking, *Stores and Restaurants* and *Schools, Libraries, and Labs (nonmfg)* are the two building types with the greatest future savings potential.

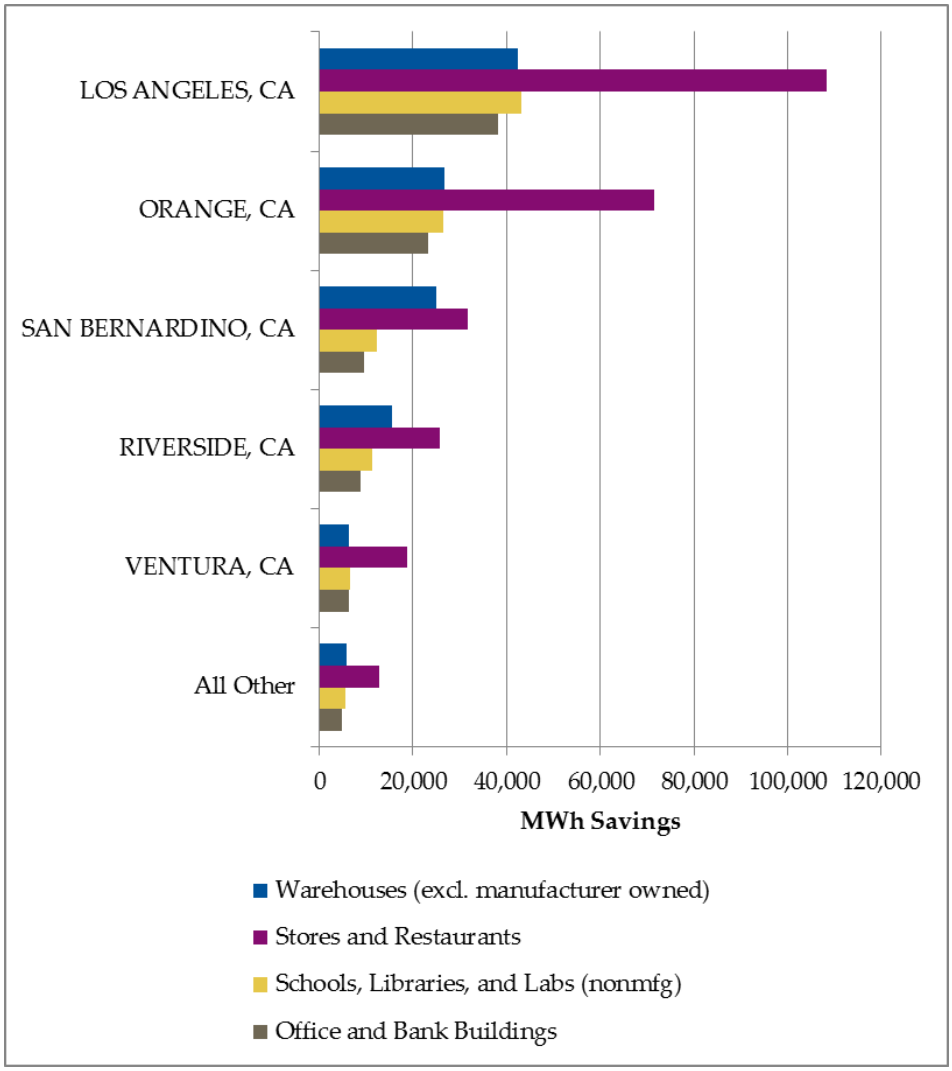
Table H-8: SCE SBD Potential - Ranked Building Types

		2013-15 Remaining Potential			2013-15 Score (Percent of total Savings)			
Rank	**Building Type**	**MWh**	**MW**	**MTherm**	**MWh**	**MW**	**MTherm**	**Average Percent**
1	Stores and Restaurants	262,970	52	0	33%	29%	0%	31%
2	Schools, Libraries, and Labs (nonmfg)	103,648	32	0	13%	18%	0%	16%
3	Warehouses (excl. manufacturer owned)	117,966	18	0	15%	10%	0%	12%
4	Office and Bank Buildings	89,631	23	0	11%	13%	0%	12%
5	Hospitals and Other Health Treatment	65,414	16	0	8%	9%	0%	9%
6	Hotels and Motels	67,536	11	0	8%	6%	0%	7%
7	Parking Garages and Automotive Services	31,420	10	0	4%	6%	0%	5%
8	Manufacturing Plants, Warehouses, Labs	32,338	4	0	4%	2%	0%	3%
9	Government Service Buildings	12,489	7	0	2%	4%	0%	3%
10	Miscellaneous Nonresidential Buildings	16,472	2	0	2%	1%	0%	2%
11	Amusement, Social and Recreational Bldgs.	4,739	1	0	1%	1%	0%	1%
12	Dormitories	0	0	0	0%	0%	0%	0%
13	Religious Buildings	0	0	0	0%	0%	0%	0%

Source: Navigant Analysis

Navigant further presents information on the portion of potential for the top four building types that reside in each county with SCE service territory. These results are illustrated in Figure H-3.

Figure 6-27: SCE SBD Potential of Top Four Building Types by County (MWh)



Source: Navigant Analysis

H.5 Past Estimates of Market Penetration and Savings Potential

Market penetration and savings potential from SBD in SCE service territory was previously estimated in the *2011 SCE SBD Study*.[63] The *2011 SCE SBD Study* differed from this study in several different ways:

- Historical data analyzed consisted of 2003 to 2008 program years.
- Projected Construction Activity only included New Construction, it did not account for Existing Building Renovation.
- Results were not produced at the county level.

[63] CADMUS. *SCE Commercial Building Market Characterization for Savings by Design Program.* 2011.

Beyond the above differences, the methodology and types of results presented in the *2011 SCE SBD* are largely the same as this study ("the Navigant Study").

Table H-9 presents the differences in participation rate results from the two studies. Note that the participation rate calculated by this study includes both new construction and existing building renovation in the Projected Construction Activity (the denominator of the participation calculation). Thus participation rates from this study are inherently lower than the *2011 SCE SBD Study*. In general building types with relatively high participation rates in the *2011 SCE SBD Study* also have relatively high participation rates in this study; the noted exception is *Government Service Buildings*.

Table H-9: SCE SBD Average Participation Rate by Building Type

Building Type	Navigant Study (based on 2006-2012 data)	2011 SCE SBD Study (based on 2006-2008 data)*
Amusement, Social and Recreational Bldgs.	1%	4%
Dormitories	0%	N/A
Government Service Buildings	1%	22%
Hospitals and Other Health Treatment	10%	17%
Hotels and Motels	7%	20%
Manufacturing Plants, Warehouses, Labs	37%	29%
Miscellaneous Nonresidential Buildings	34%	21%
Office and Bank Buildings	17%	11%
Parking Garages and Automotive Services	0%	1%
Religious Buildings	0%	1%
Schools, Libraries, and Labs (nonmfg)	12%	28%
Stores and Restaurants	12%	24%
Warehouses (excl. manufacturer owned)	25%	21%
All Building Types	**13%**	**21%**

Source: Navigant Analysis and 2011 SCE SBD Study.

*Note: Basis for participation rate did not include existing building renovations

Table H-10 presents a comparison of savings per square foot from historical program participants.

Table H-10: SCE SBD Average Savings per Square Foot

Building Type	Navigant Study kWh/Sqft	2011 SCE SBD Study kWh/Sqft	Navigant Study kW/Sqft	2011 SCE SBD Study kW/Sqft
Amusement, Social and Recreational Bldgs.	0.9	1.8	0.0004	0.0003
Dormitories	0	N/A	0	N/A
Government Service Buildings	2.5	13.2	0.0014	0.0010
Hospitals and Other Health Treatment	2.3	3.3	0.0004	0.0004
Hotels and Motels	2.4	1.5	0.0003	0.0004
Manufacturing Plants, Warehouses, Labs	6.1	5.4	0.0008	0.0009
Miscellaneous Nonresidential Buildings	10.4	3.7	0.0011	0.0004
Office and Bank Buildings	3.3	1.8	0.0010	0.0003
Parking Garages and Automotive Services	0.9	0.4	0.0003	0.0000
Religious Buildings	0	1.9	0	0.0005
Schools, Libraries, and Labs (nonmfg)	2.7	1.6	0.0012	0.0005
Stores and Restaurants	4.4	4.7	0.0009	0.0011
Warehouses (excl. manufacturer owned)	2.8	2.4	0.0004	0.0004

Source: Navigant Analysis

Table H-11 and Table H-12 document the results of the future analysis from the *2011 SCE SBD Study*. The *2011 SCE SBD Study* forecasted the largest remaining energy (MWh) potential in 2012 would be from *Government Service Buildings* and *Stores and Restaurants* (Table H-11) while the largest remaining demand (MW) potential in 2012 would be from *Stores and Restaurants* and *Religious Buildings,* Table H-12. This study also forecasts that *Stores and Restaurants* continue to be a major building type with remaining potential but places *Government Service Buildings* and *Religious Buildings* at a much lower potential. Several reasons lead to these results:

- The *2011 SCE SBD Study* observed kWh savings per square foot for *Government Service Buildings* approximately five times larger than that observed by this study. Savings per square foot for *Government Service Buildings* was observed by this study to be relatively consistent with other building types.
- The data set made available to Navigant for this study did not contain and participants from *Religious Buildings.* Thus an average savings per square foot could not be calculated.
- Savings per square foot for *Stores and Restaurants* match relatively well between this study and the *2011 SCE SBD Study*.

Annual remaining savings potential for all building types was forecasted in 2012 as approximately 89,000 MWh by the *2011 SCE SBD Study* while this study estimates approximately 249,000 MWh (see Table H-11). The main reason for the increased savings potential in this study is the consideration of potential in existing building renovations which increases the eligible population of participants.

Table H-11: *2011 SCE SBD Study,* Savings Potential for SCE (MWh)

Building Type	2006	2007	2008	2009	2010	2011	2012
Amusement, Social and Recreational Bldgs.	3,788	3,322	3,007	2,684	1,257	2,411	3,102
Dormitories	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Government Service Buildings	8,565	11,596	13,246	12,506	9,190	19,987	22,604
Hospitals and Other Health Treatment	7,837	9,065	11,819	9,312	9,046	6,877	5,979
Hotels and Motels	2,393	4,400	4,263	1,916	855	849	963
Manufacturing Plants, Warehouses, Labs	16,891	9,748	24,258	9,402	5,980	3,036	4,494
Miscellaneous Nonresidential Buildings	3,123	2,657	847	2,158	5,174	4,328	7,616
Office and Bank Buildings	12,589	17,348	14,975	6,027	1,980	2,447	3,327
Parking Garages and Automotive Services	4,389	4,693	3,973	2,799	1,077	1,215	1,650
Religious Buildings	1,992	1,904	1,198	985	854	1,549	1,163
Schools, Libraries, and Labs (nonmfg)	10,132	11,041	11,100	11,192	13,144	6,880	8,679
Stores and Restaurants	55,200	47,097	60,126	44,432	11,163	12,743	19,092
Warehouses (excl. manufacturer owned)	50,068	51,197	54,707	29,175	8,208	8,130	10,556
Total	**176,968**	**174,069**	**203,519**	**132,588**	**67,928**	**70,454**	**89,226**

Source: 2011 SCE SBD Study.

Table H-12: *2011 SCE SBD Study*, Savings Potential for SCE (MW)

Building Type	2006	2007	2008	2009	2010	2011	2012
Amusement, Social and Recreational Bldgs.	0.6	0.5	0.5	0.4	0.2	0.4	0.5
Dormitories	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Government Service Buildings	0.7	0.9	1.0	1.0	0.7	1.6	1.8
Hospitals and Other Health Treatment	0.9	1.1	1.4	1.1	1.1	0.8	0.7
Hotels and Motels	0.7	1.2	1.2	0.5	0.2	0.2	0.3
Manufacturing Plants, Warehouses, Labs	2.8	1.6	4.0	1.5	1.0	0.5	0.7
Miscellaneous Nonresidential Buildings	0.4	0.3	0.1	0.2	0.6	0.5	0.9
Office and Bank Buildings	2.3	3.2	2.7	1.1	0.4	0.4	0.6
Parking Garages and Automotive Services	0.5	0.5	0.4	0.3	0.1	0.1	0.2
Religious Buildings	0.6	0.5	0.3	0.3	0.2	0.4	0.3
Schools, Libraries, and Labs (nonmfg)	2.9	3.2	3.2	3.2	3.8	2.0	2.5
Stores and Restaurants	13.0	11.1	14.1	10.4	2.6	3.0	4.5
Warehouses (excl. manufacturer owned)	8.5	8.7	9.3	4.9	1.4	1.4	1.8
Total	**33.7**	**32.8**	**38.3**	**25.1**	**12.3**	**11.4**	**14.7**

Source: 2011 SCE SBD Study

Appendix I. Glossary

CALGreen – The California Green Building Standards code is the first statewide "green" building code adopted in the U.S. This code requires that every building built in California after January 1, 2011 meet baseline efficiency and sustainability standards.

Collaborative for High Performance Schools (CHPS) – A national program focused on the design of high performance schools including healthy, comfortable, and energy and material efficient spaces.

Design/Bid/Build (DBB): A formal building design process characterized by separate design and construction teams.

Design/Build with Contractors (DBwC): A building design process characterized by a General Contractor being responsible for both design and construction.

Design/Build with Design Team (DBwDT): A building design process characterized by one firm being responsible for both design and construction.

Future Savings Potential: The savings that are potentially possible if every eligible new construction project participated in the Savings by Design program, this is determined in comparison to a business-as-usual approach which assumes historical participation rates remain constant.

Gap analysis: The process by which future savings potential is determined. The calculation considers the projected non-participants and the average savings that will be attributable to each.

Historic Market Penetration: The amount of new construction activity which has historically participated in the Savings by Design program.

Investor Owned Utilities (IOUs): California's electric providers. For this report the important IOUs are those that participate in the Savings by Design program, which include Pacific Gas and Electric (PG&E), San Diego Gas and Electric (SDG&E) and Southern California Edison (SCE).

Leadership in Energy and Environmental Design (LEED) – A green building rating system run by the U.S. Green Building Council, focused on the efficient use of resources and environmental responsibility.

Non-Residential New Construction (NRNC) – Any new construction project that cannot be classified as residential construction; this describes the set of buildings that are eligible for the SBD program.

Savings by Design (SBD): The major energy efficiency program offered through California's Investor Owned Utilities (IOUs) that aims at transforming the non-residential new construction market.

Zero Net Energy Buildings: Several variant definitions exist. For the purposes of this study we define ZNE Buildings as buildings that generate with renewable resources at least as much energy as they consume over the course of a year.