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Industry Research and Recommendations for Small Buildings and Small Portfolios

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Technical Report
NREL/TP-5500-57776
December 2013

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Prepared under Task No. BEC8.1115

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Thank you to the many members of the Small Buildings and Small Portfolios (SBSP) community who contributed input and feedback on the SBSP sector and provided recommendations on approaches to address energy efficiency in the sector. We would also like to acknowledge Maureen McIntyre, Natalie Gregory, and the NREL communications team for editing and reviewing the document.

Nomenclature

AERG	Advanced Energy Retrofit Guide
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BOMA	Building Owners and Managers Association
BPD	Building Performance Database
BTO	Building Technologies Office
CBECS	Commercial Buildings Energy Consumption Survey
DEEP	Deep Energy Efficiency Potential
DOE	U.S. Department of Energy
EEM	energy efficiency measure
EERE	DOE Office of Energy Efficiency and Renewable Energy
ESCO	energy service company
EUI	energy use intensity
HVAC	heating, ventilating, and air conditioning
NREL	National Renewable Energy Laboratory
NSBA	National Small Business Association
PPA	power purchase agreement
PGL	Preservation Green Lab
SBA	U.S. Small Business Administration
SBSP	Small Buildings and Small Portfolios

Executive Summary

Small buildings have been left behind in the energy efficiency marketplace because financial and technical resources have flowed to larger commercial buildings (PGL 2013). DOE's Building Technologies Office (BTO) works with the commercial building industry to accelerate the uptake of energy efficiency technologies and techniques in existing and new commercial buildings (DOE 2013). BTO recognizes the SBSP sector's potential for significant energy savings and the need for investments in resources that are tailored to this sector's unique needs. The industry research and recommendations described in this report identify potential approaches and strategic priorities that BTO could explore over the next 3–5 years that will support the implementation of high-potential energy efficiency opportunities for this important sector.

DOE is uniquely positioned to provide national leadership, objective information, and innovative tools, technologies, and services to support cost-effective energy savings in the fragmented and complex SBSP sector. Properly deployed, the DOE effort could enhance and complement current energy efficiency approaches.

For this report, small buildings are defined as buildings smaller than 50,000 ft^2; however, the average small building is smaller than 8,000 ft^2. Small portfolios are loosely and qualitatively defined as portfolios of buildings that include only a small number of small buildings. This distinction is important because the report targets portfolio owners and managers who generally do not have staff and other resources to track energy use and pursue energy efficiency solutions.

Research conducted as part of this effort identified a number of challenges to the adoption of energy efficiency solutions. SBSP owners and operators and the third-party service providers who cater to them are often hard to reach, and the sector's fragmentation has created many barriers that prevent businesses from aligning their operation goals with energy conservation goals (PGL 2013). The largest reported barriers include:

- Limited capital
- Higher transaction costs relative to energy cost savings
- Lack of time to research and implement energy efficiency solutions
- Split incentive obstacles between owners and tenants
- Lack of available sector-specific resources and technologies.

Market barriers also exist. Service providers, utilities, and financial institutions often cater to larger players because energy savings in bigger buildings provide faster and more attractive returns on investment. In addition, energy efficiency solutions are more easily adopted and disseminated across sizable building portfolios because energy savings are typically larger relative to the transaction costs.

Further, convenience and emotional drivers typically motivate decisions in the SBSP sector (PGL 2013). In many ways, the SBSP sector is more similar to the residential building market than to the large commercial sector. This is particularly true of the relative resources small

building owners and homeowners have available to pursue energy efficiency, as well as their risk profiles and creditworthiness.

Owners and operators are concerned about increases in energy costs, but many lack the time and capital to spend on anything unrelated to day-to-day operations. Even when small building owners want to improve energy efficiency, few reliable, accessible, affordable, and user-friendly tools and resources are available. They may understand the potential return on investment, but lack the resources to invest in detailed energy audits and comprehensive financial analyses. Hence, there is a gap between stakeholder interest in reducing energy costs and actions that improve energy efficiency. This gap strongly indicates a need for additional support to improve energy efficiency in this sector.

Despite the challenges, the size of the SBSP sector makes it an attractive opportunity, for the following reasons:

- More than 90% of U.S. commercial buildings—a total of 4.6 million—are smaller than 50,000 ft^2 (CBECS 2003).
- These buildings account for 51% of total floor space (CBECS 2003).
- The average small commercial building is smaller than 8,000 ft^2 (PGL 2013).
- The sector consumes more than 40% of the energy used in U.S. commercial buildings, offering large potential energy savings (CBECS 2003).

One study estimates that a well-designed SBSP initiative could result in 1.07 quadrillion Btu of site energy savings or $30 billion in energy cost savings every year (PGL 2013).

The research also shows that many small buildings house small businesses. Nationwide, small businesses account for half of all private sector employees, and have generated 65% of net new jobs during the past 17 years (SBA 2013). Small businesses are widely acknowledged to be a major driver of the U.S. economy; however, they typically operate on slim profit margins (Forbes 2013). Dollars saved through energy efficiency improvements directly impact their bottom lines.

This report presents a potential course of action that provides a path to significant energy savings and identifies unique roles and key opportunities for DOE. NREL researchers who developed the report took a strategic approach to (1) understand and characterize the current state of the SBSP sector; (2) identify specific sector needs, as well as opportunities to encourage widespread adoption of energy efficiency solutions on a national scale; and (3) narrow the approaches, opportunities, and priorities to those appropriate for DOE support. These potential key opportunities and focus areas for DOE include:

- Provide greater confidence that energy efficiency investments will be successful for small building owners by proving cost effectiveness of the investments through demonstration projects and case studies that include detailed cost data and performance verification.
- Enable small building owners and third-party service providers to make solid investment decisions at the building and district levels by developing simple tools that enhance

energy audit and loan application processes for small buildings, overcoming high transaction costs and lack of owner expertise.

- Engage and incentivize manufacturers and contractors to produce and install high-efficiency equipment, controls, and other technologies that are appropriate for small buildings.
- Help remove organizational and administrative barriers by identifying or developing SBSP-specific guidance and materials that address barriers such as cumbersome tax credit documentation and split incentive obstacles.
- Encourage submission to DOE's open, interactive energy datasets and platforms to address the lack of benchmarking data and enable owners, utilities, and financiers to identify the best energy savings opportunities for small buildings.
- Help make the SBSP community more energy efficient by establishing sector-specific, long-term energy goals and research priorities.
- Characterize and support third-party service providers so they are better aligned with design resources and incentive programs.

Concentrating DOE resources on these efforts could focus research, development, and evaluation; demonstrate scalability; guide deployment plans; and provide pathways for analysis and tools to apply to policy, codes, and energy efficiency incentive programs. Adapting and improving DOE programs and tools could help bridge the gap between stakeholder interest in reducing energy costs and actions to achieve significant energy savings.

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1 Introduction

The U.S. Department of Energy's (DOE) Building Technologies Office (BTO) works with the commercial building industry to accelerate the uptake of energy efficiency technologies and techniques in existing and new commercial buildings (DOE 2013). Through the goals and possible strategic priorities identified in this report, BTO can focus research efforts to develop and share vetted information that the market can use to deploy strategies and proven technologies that promote energy savings in small buildings and small portfolios (SBSP) over the next 3–5 years.

These energy savings represent an enormous opportunity. According to the Commercial Buildings Energy Consumption Survey (CBECS), the SBSP sector comprises 4.6 million small buildings and consumes more than 40% of the energy used in U.S. commercial buildings (CBECS 2003). For this report, small buildings are defined as buildings smaller than 50,000 ft^2; however, the average small building is smaller than 8,000 ft^2. Small portfolios are loosely and qualitatively defined as portfolios of buildings that include only a small number of small buildings. This distinction is important because the report targets portfolio owners and managers who generally do not have staff and other resources to track energy use and pursue energy efficiency solutions.

Assuming a maximum potential energy savings of 45%, derived by data presented in the Advanced Energy Retrofit Guides (AERGs) (DOE 2012), the SBSP sector could save 1.07 quadrillion Btu (quads) of annual site energy, which translates to $30 billion in energy cost savings per year (PGL 2013). Energy savings may vary from one building to the next, but the magnitude of the aggregate savings illustrates the potential impact of a well-designed SBSP initiative.

Despite the potential for extremely large energy savings, DOE programs historically have not targeted this audience. The sector's fragmentation and complexity are major reasons: they create many barriers that inhibit the widespread adoption of energy efficiency solutions. The largest reported barriers that SBSP owners and operators face include:

- Limited capital
- Higher transaction costs relative to energy cost savings
- Lack of time to research and implement energy efficiency solutions
- Split incentive obstacles between owners and tenants
- A lack of available sector-specific resources and technologies.

Market barriers also exist. Service providers, utilities, and financial institutions often cater to larger players because the more substantial energy savings in bigger buildings provide faster and more attractive returns on investment. In addition, energy efficiency solutions are more easily adopted and disseminated across sizable building portfolios, because energy savings are typically larger relative to the transaction costs in bigger buildings and portfolios. These players also often have capital and staff time to invest in researching and implementing efficiency solutions.

Despite the challenges, the potential energy savings in the SBSP sector justify research, development, and deployment efforts. To tackle this opportunity, National Renewable Energy Laboratory (NREL) researchers developed this report, which identifies potential approaches and strategic priorities for DOE to explore over the next 3–5 years. This potential course of action provides a path to significant energy savings and identifies unique roles and key opportunities for DOE to support and accelerate the adoption of energy efficiency solutions. It also identifies potential improvements to current programs as well as innovative approaches.

This report focuses primarily on existing buildings, but NREL also developed a proposed framework for improving energy efficiency in new commercial buildings that includes specific recommendations for small commercial new construction projects (NREL 2013). Together, the SBSP report and current research and initiatives related to new construction identify possible high-priority focus areas for DOE to support energy efficiency in this sector's new and existing buildings.

2 Research Approach

NREL researchers focused on leveraging available resources, supplementing those resources with additional analysis, and collecting targeted stakeholder input. The process comprised three major tasks:

Task 1: Initial scoping and characterization of the SBSP sector

Task 2: Gap analysis and stakeholder input

Task 3: Development of the SBSP report, including key focus areas for DOE.

To accomplish these tasks, NREL researchers:

- Collected data from reports, journal articles, and other research.
- Engaged in telephone conversations with industry stakeholders.
- Subcontracted with the National Trust for Historic Preservation's Preservation Green Lab (PGL) to write a report on its past research about the energy efficiency potential of small buildings (PGL 2013).
- Solicited comments and recommendations from key stakeholders through a peer review of the first draft.

The peer reviews served as a way to vet the information in the report. NREL researchers used the feedback from peer reviewers to develop the second and final drafts. They also used data from Tasks 1 and 2 to answer the following questions:

- Is the energy savings potential for the SBSP sector significant?
- Does the SBSP sector need additional support for energy efficiency solutions?
- Is DOE's unique role required and—if it is—how can DOE be most effective?
- Who are the potential non-DOE project development and deployment partners and are they sufficiently committed?

With these questions in mind, NREL researchers took a strategic approach to developing the report (see Figure 1). The intents were to (1) understand and characterize the current state of the SBSP sector (additional data supporting the sector characterization is found in Appendix A); (2) identify specific sector needs and opportunities to encourage widespread adoption of energy efficiency solutions on a national scale; and (3) narrow the goals and priorities to those appropriate for DOE support. Recommendations and feedback from stakeholders during the phone conversations, as well as the peer reviews of the first draft, were critical to developing and vetting the report recommendations.

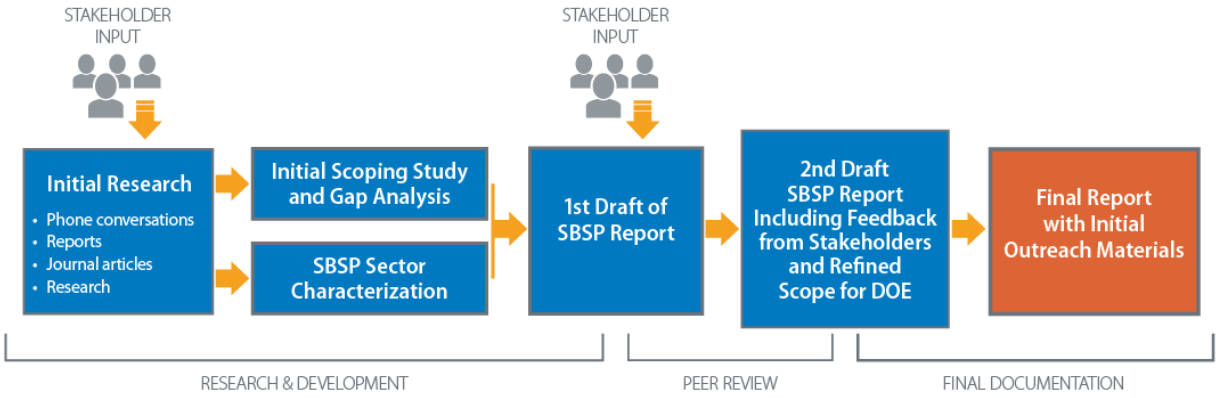

Figure 1. Schematic of the strategic approach used to develop the SBSP report

The result is a report that identifies possible high-potential energy efficiency opportunities and strategic priorities for DOE to explore over the next 3–5 years. It also highlights key roles for sector stakeholders, including collaborative opportunities with DOE (Appendices B and C), and recommends improvements to current programs and innovative approaches to encourage energy efficiency across the sector (Section 4.3).

3 Current State of the SBSP Sector

The small building sector is vast and diverse, and accounts for a large fraction of the energy consumed by U.S. commercial buildings. More than 90% of U.S. commercial buildings are smaller than 50,000 ft^2, accounting for 51% of total commercial building floor space (including malls) (CBECS 2003). These buildings consume nearly 3,000 trillion Btu, accounting for 44% of energy consumed by all commercial buildings (CBECS 2003). On average, small commercial buildings are smaller than 8,000 ft^2, with an average energy use intensity (EUI) of 80 kBtu/ft^2/yr (PGL 2013). For comparison, the average EUI for all CBECS buildings is 92 kBtu/ft^2/yr, and buildings larger than 50,000 ft^2 average 102 kBtu/ft^2/yr (PGL 2013).

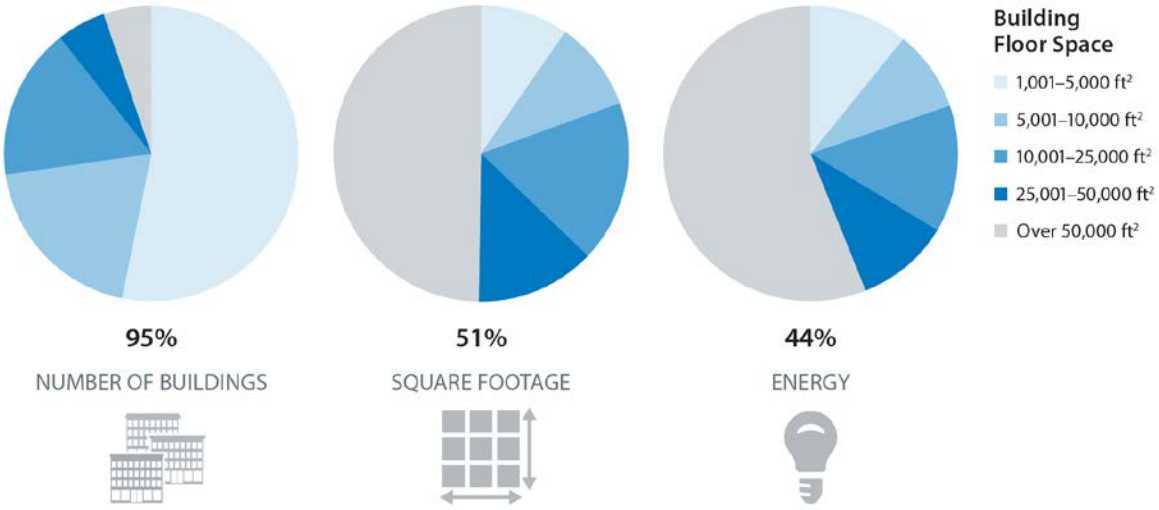

Figure 2. Breakdown of the small building sector by number of buildings, floor space, and energy use

(CBECS 2003)

For this report, small portfolios are loosely and qualitatively defined as portfolios of buildings that include only a small number of buildings smaller than 50,000 ft^2—many are smaller than 8,000 ft^2. The portfolio owners and managers generally do not have staff and other resources to track energy use and pursue energy efficiency solutions. This report describes strategies and processes for identifying and engaging these stakeholders.

Small buildings often house small businesses. According to the National Small Business Association (NSBA), the United States has approximately 26.9 million small businesses (NSBA 2011). A small business, as defined by the U.S. Small Business Administration (SBA), is independently owned and operated, is organized for profit, and is not dominant in its field of operation (SBA 2012). PGL estimates that the 4.6 million small commercial buildings are home to approximately 5.9 million small (fewer than 500 employees) employer businesses nationwide (PGL 2013). CBECS data show that the average small building houses approximately 1.5 businesses (see Figure 3) (PGL 2013). This indicates that of the 6.9 million businesses (4.6 million × 1.5) that occupy small buildings, 5.9 million are small. Thus, it is

important to consider small businesses when developing energy efficiency solutions for the SBSP sector.

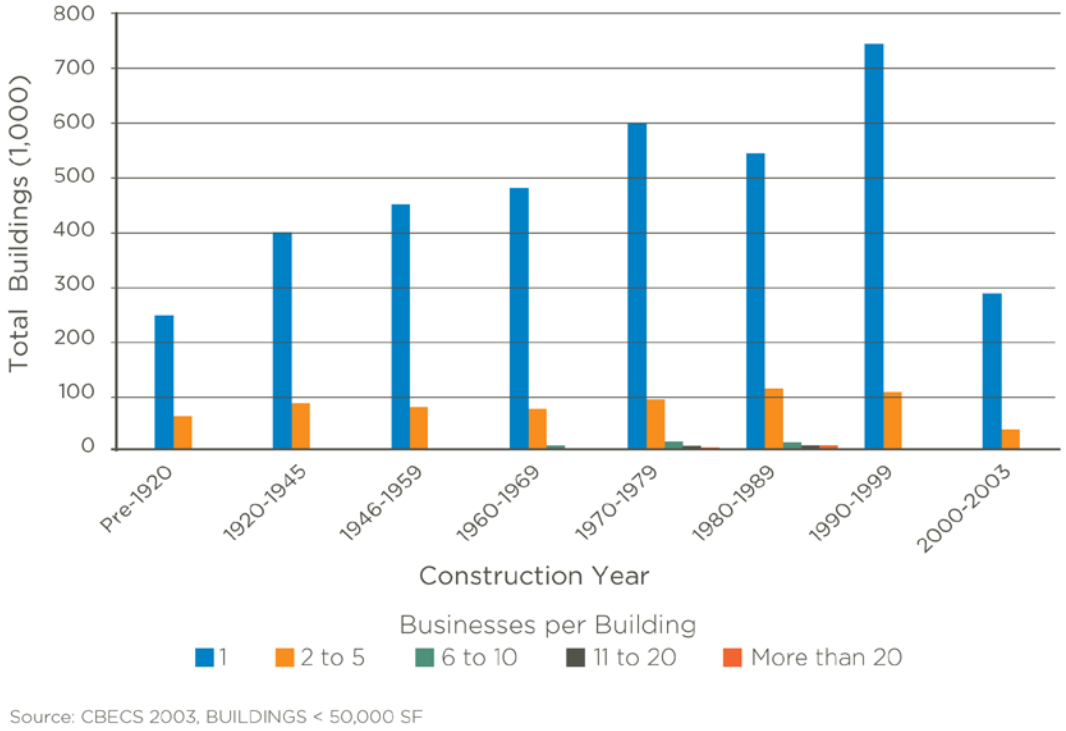

Figure 3. Number of establishments by construction vintage

(PGL 2013)

In addition, small businesses account for half of all private sector employees nationwide, and have generated 65% of net new jobs during the past 17 years (SBA 2013). The SBSP sector is widely acknowledged to be a major driver of the U.S. economy; however, small businesses typically operate on slim profit margins (Forbes 2013), and dollars saved through energy efficiency improvements directly impact their bottom lines.

The NSBA (2011) conducted a survey to understand the concerns of small businesses about energy efficiency and the approaches they are using to save energy. The NSBA gathered information from more than 200 members, and found that:

- Forty percent cited limited capital as the primary obstacle to making their businesses more energy efficient.
- Twenty percent did not have the time to research and implement energy efficiency strategies.
- Nine percent mentioned a lack of resources.
- Eight percent mentioned that sector-specific technologies are not available.

Of the businesses that chose "other" in this survey, the most common reasons they gave for not improving the energy efficiency of their buildings included the poor economy, the fact that they lease their facilities, and a lack of time (see Table 1).

Table 1. NSBA 2011 Energy Survey—Main Obstacles Preventing Small Businesses From Becoming More Energy Efficient

Obstacle	Survey Results (% of Affirmative Responses)
Cash flow	40%
Lack of time to research and implement	20%
Other	14%
Lack of resources	9%
Don't know	9%
Available technology	8%

Although the small business owners and operators surveyed acknowledged obstacles to making their businesses more energy efficient, they did worry about energy expenses. Fifty-two percent of respondents said they were very concerned (40% were moderately concerned) about future energy costs, and 82% had taken one or more steps to reduce energy consumption. Of those businesses, 88% reported that the primary reason was to save money. For 6%, the primary reason was to reduce their company's impact on the environment, and 2% saved energy to enhance their businesses' brands or reputations.

The NSBA (2011) further stated that:

- Awareness of government- and utility-backed energy efficiency programs has increased over the past several years.
- Awareness of the ENERGY STAR® product label and technical support program increased 5% between 2009 and 2011.
- Fifty-four percent of surveyed NSBA members were aware of local utility-sponsored programs, although only 27% have actually used them.
- Thirty-seven percent did not know about utility-sponsored programs.
- Only 5% of surveyed businesses had participated in utility-sponsored on-bill financing programs, which allow customers to repay energy efficiency loans to upgrade or retrofit their businesses through extra charges on their utility bills. However, on-bill financing programs are relatively new and have been adopted by only a fraction of utility providers across the nation.

Understanding the SBSP sector's behaviors, barriers, and challenges helps stakeholders overcome the obstacles that inhibit broad adoption of efficiency solutions. This research

identified a gap between stakeholders' expressed interest in reducing energy costs and actions that improve energy efficiency. The SBSP report used this information to identify high-priority focus areas for DOE that help bridge this gap (see Figure 4).

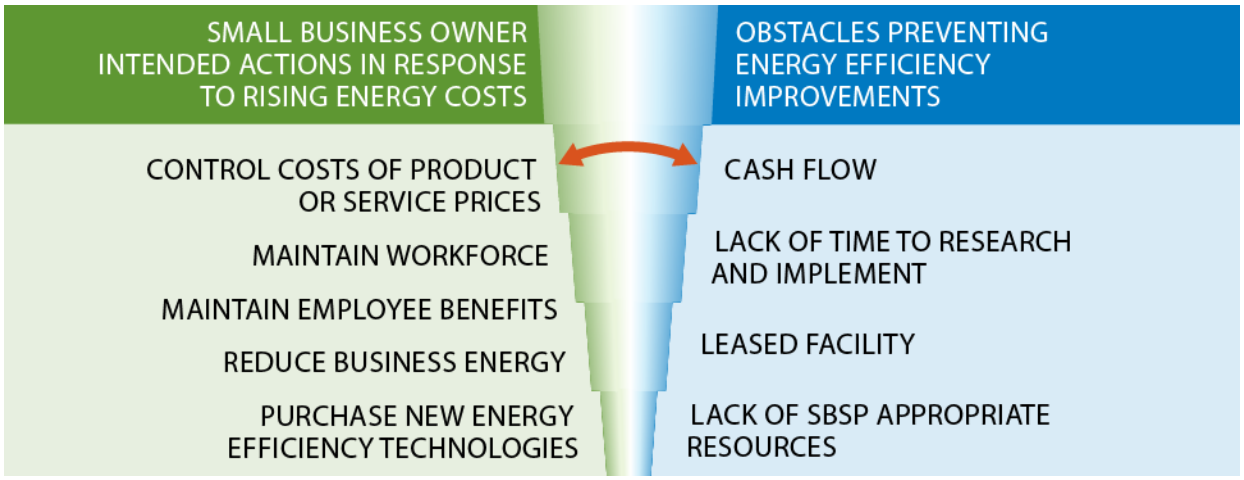

Figure 4. The gap between stakeholder interest in reducing energy costs and actions taken to improve the energy efficiency of small buildings

3.1 Characterization of Small Building Types

Characterization studies of the SBSP sector helped NREL researchers identify the most appropriate strategies to support broad adoption of energy efficiency solutions. One study identified and established core characteristics of small buildings across the United States (PGL 2013). This research included a study of nearly 800 small buildings in 10 U.S. markets. PGL paired that work with a market prioritization study and an analysis of CBECS microdata.

The result is a comprehensive small building typology that identified seven primary building types (and 26 building subtypes) with a high potential for energy savings. PGL researchers analyzed each building type based on the number of buildings, square footage, and aggregate energy consumption. The target building types and subtypes are shown in Table 2; data on average energy consumption for each target building type are shown in Table 3. Additional data from the PGL study can be found in Appendix A.

Table 2. National Survey Building Types From PGL

Original Characterization Types		Final Types
1	1 story; freestanding; post-WWII; restaurant	Food service and food sales; freestanding; single use
2	1 story; freestanding; pre-WWII; restaurant	
3	1 story; freestanding; post-WWII; grocery store	
4	1 story; freestanding; pre-WWII; office	Office; freestanding; single use
5	1 story; freestanding; post-WWII; office	
6	2+ story; freestanding; post-WWII; office	
7	Freestanding; pre-WWII; school; primary and secondary	Schools
8	Freestanding; pre-WWII; school; conversion to retail, offices, multi-family, etc.	
9	Freestanding; post-WWII; school	
10	1 story; attached; post-WWII; strip mall	Strip mall
11	1 story; freestanding; pre-WWII; retail	Retail; freestanding; single use
12	1 story; freestanding; post-WWII; retail	
13	Freestanding; post-WWII; lodging; external circulation	Lodging
14	Attached or freestanding; pre-WWII; lodging; boutique hotel	
15	2+ story; attached; converted warehouse/showroom; pre-WWII; office over office	Main Street
16	2+ story; attached; converted warehouse/showroom; pre-WWII; office over retail	
17	2+ story; attached; converted warehouse/showroom; pre-WWII; office over restaurant	
18	2+ story; attached; converted warehouse/showroom; pre-WWII; multi-family over office	
19	2+ story; attached; converted warehouse/showroom; pre-WWII; multi-family over office	
20	2+ story; attached; pre-WWII; Main Street; office over office	
21	2+ story; attached; pre-WWII; Main Street; office over retail	
22	2+ story; attached; pre-WWII; Main Street; office over restaurant	
23	2+ story; attached; pre-WWII; Main Street; multi-family over restaurant	
24	2+ story; attached; pre-WWII; Main Street; multi-family over retail	
25	2+ story; attached; pre-WWII; Main Street; multi-family over office	
26	1 story; attached; pre-WWII; neighborhood storefront rows	

Table 3. Key Commercial Subsectors To Target for Energy Efficiency

Target Building Types	Average EUI (kBtu/ft²)	Share of Buildings	Share of Energy	Annual Consumption (TBtu)
Food Service—freestanding, single use	233	8%	7%	432
Main Street	105	7%	4%	235
Strip Mall—attached, multiple use	104	4%	4%	251
Lodging—all configurations	91	2%	2%	107
Retail—freestanding, single use	89	6%	4%	213
Office—freestanding, single use	86	14%	8%	471
Schools—all configurations	83	7%	5%	305
All selected building types	105	49%	33%	2014

PGL's detailed sector analysis describes distinctive characteristics of the seven targeted building types, owners' motivations for adopting energy efficiency solutions, and the barriers that inhibit their adoption. A summary of these findings follows (PGL 2013):

Most U.S. commercial buildings are small, diverse in physical characteristics and use patterns, and offer substantial energy efficiency opportunities.

- The sector represents 4.6 million small buildings and 5.9 million small businesses.
- The average building is smaller than 8,000 ft^2.
- There is a potential 1.07 quads of annual site energy savings, which equates to $30 billion in energy cost savings annually.

A high proportion of energy use is concentrated in a few primary building types.

- Seven major building types were studied: food service, main street, strip mall, lodging, retail, office, and schools. (As delineated by PGL, main street buildings are smaller, older buildings that are predominantly mixed use.) They represent more than 2 million buildings, 19 billion ft^2, and 3.6 million businesses. In aggregate, they consume about 2 quads of energy annually.

There are more similarities between the residential building market and the small commercial sector than between the large and small commercial sectors.

- Owners are involved with operational decision making in more than 60% of small commercial buildings (see Figure 5).
- Decisions are largely motivated by convenience and emotional drivers such as business identity and relationships with peers in the direct vicinity.

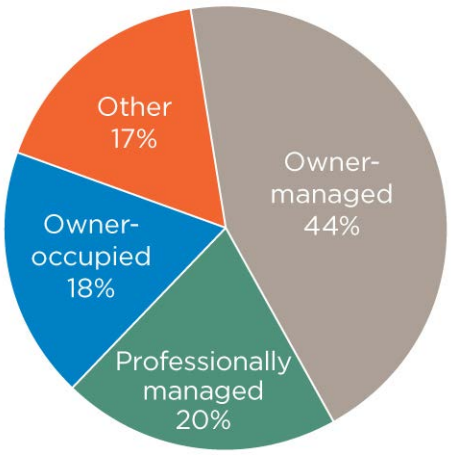

Figure 5. PGL survey—small buildings ownership and management

(PGL 2013)

Small commercial buildings are often aggregated in business districts of similar building types with high potential for energy savings.

- District- or neighborhood-level aggregation is a clear way to address the diverse, fragmented SBSP market and enable economically scalable applications of retrofit strategies.
- Buildings and communities in most need of retrofits are often Class B and Class C properties—second- and third-tier buildings in terms of quality—as described by the Building Owners and Managers Association (BOMA 2013).

Buildings typical of main street consume more energy than buildings of similar use types nationally and offer significant potential for energy savings because of physical features and close relationships between owners and occupants.

- Most main street buildings were constructed before 1960 (see Figure A–4 in Appendix A).
- Primary uses of main street buildings are retail, food service, office space, warehouse/ automotive, education, and multifamily living space.

Freestanding food service and sales establishments have the highest EUIs of any type of small building.

- Almost 400,000 U.S. food service and food sales establishments are smaller than 50,000 ft^2.
- The opportunity to directly increase business profitability through energy savings is greatest in freestanding food service and sales buildings because of their low profit margins and high energy costs.

Retail establishments and strip malls are vastly different subsectors.

- Retail businesses that occupy small buildings are typically clustered in business districts, often in neighborhoods of older buildings.
- Strip malls are more energy intensive. They are also predominantly owned by one entity and professionally managed.

In addition to these findings, PGL's research also identified four main elements that define the SBSP sector (PGL 2013):

- Smaller buildings, in particular main street buildings, and portfolios have inherent strengths.
- Decision makers lack information, knowledge, and time.
- Energy codes are poorly aligned to the opportunities in existing buildings.
- The SBSP sector is large and fragmented and is not aligned around the goal of saving energy.

Smaller buildings, in particular main street buildings, and portfolios have inherent strengths.

Old buildings, in particular, often have features that were designed to satisfy the comfort and performance needs of occupants in an era of energy and fuel scarcity. Energy savings can be leveraged from inherent features of these building such as high mass, daylight, natural ventilation, and proximity to other buildings. Most retrofit programs and incentives, however, do not consider these features as part of the energy savings potential.

Decision makers lack information, knowledge, and time.

A survey conducted by the Institute for Building Efficiency (2011) identified three significant barriers to energy efficiency in the U.S. commercial building marketplace:

- Capital and information about financial incentives for efficiency projects are not available.
- Projects cannot meet the organization's financial payback criteria.
- Decision makers do not trust that promised savings will be achieved.

Lack of time and technical knowledge to implement efficiency solutions are issues for building owners and tenants; however, they also apply to the small contractors that serve these businesses. Third-party service providers often lack the training or experience to apply advanced technical strategies to small buildings, so they need small building-specific energy efficiency educational materials and guidance. Easy-to-access information is also needed that provides instruction and promotes awareness of energy savings opportunities.

Energy codes are poorly aligned to the opportunity in existing buildings.

Energy efficiency tools and energy codes are typically tailored to new and larger buildings. The time necessary to enter information into energy efficiency tools can overwhelm the available resources of small businesses. Building codes also provide minimum standards and often ignore actual energy use, provide no incentive to encourage energy-saving behaviors, neglect interactions among building elements that can affect energy use, and have no positive feedback loop to determine effectiveness (PGL 2013).

The SBSP sector is large, fragmented, and misaligned.

Small buildings are often clustered in business districts or held in portfolios. The business districts or portfolios often have staffs that are paid to align the interests of diverse businesses or divisions around multiple shared goals. Successful business district associations drive economic development, customer outreach, and community improvement, and can be leveraged to align small businesses and building owners around the goal of improving energy efficiency. Approximately 5,400 business district organizations with professional staff, including national small business and community outreach organizations, business improvement districts, local service areas, downtown associations, and some historic districts, are available nationwide (PGL 2013).

These research findings provide key insights on the characteristics of buildings in the SBSP sector. NREL researchers used this information to prioritize possible key focus areas for DOE that could have a great impact on energy efficiency in this sector.

3.2 Key Stakeholders

Stakeholders integrate best practices in the marketplace, so they are critical to improving energy efficiency in commercial buildings. NREL researchers conducted a high-level stakeholder analysis to understand key players and their roles, levels of knowledge, and perceptions of benefits and barriers.

The study focused on a subset of the SBSP community for which data were readily available and accessible. Audience groups included small business owners, small building owners, building managers, utility companies and financial institutions, and third-party service providers. Table 4 summarizes an evaluation of this subset of stakeholders.

Table 4. Target Audience Analysis of the SBSP Sector

Audience	Role in Making Energy Saving Decisions	Level of Knowledge About Energy Efficiency	Priority for Implementing Energy Efficiency Solutions	Potential Benefits From Implementing Energy Efficiency Solutions	Barriers to Energy Efficiency Solutions
Small business owner	Primary decision maker	Low-moderate	Moderate	1. Energy cost savings 2. Reduce company's impact on the environment 3. Make a product more competitive 4. Lower customer pricing 5. Enhance business brand/reputation 6. Address employee concerns or requests	1. Limited capital 2. Lack of time to research and implement 3. Leased facility (split incentive) 4. Lack of resources and available technology 5. Current incentives are too difficult to understand and process
Small building owner	Primary decision maker	Moderate	Moderate	1. Energy cost savings 2. Reduce building's impact on the environment 3. Address tenant concerns or requests	1. Limited capital 2. Lack of time to research and implement 3. Leased facility (split incentive) 4. Lack of resources and available technology 5. Current incentives are too difficult to understand and process
Building manager and operator	Secondary decision maker	Low-moderate	Low	1. Energy cost savings 2. Reduce building's impact on the environment 3. Address tenant concerns or requests	1. Lack of time to research and implement 2. Lack of resources and available technology 3. Current incentives are too difficult to understand and process 4. Lack of information on control sequences
Utility companies and financial institutions	Influencer	High	Moderate-high	1. Reduce long term energy costs 2. Deferred capital expenditure	1. Lack of information on aggregated SBSP energy consumption 2. Lack of information to determine scalable, low-cost solutions to the SBSP sector
3rd Party service providers	Influencer	Low-moderate	High	1. Increased revenue for 3rd-party service providers 2. Provide solutions to aggregated communities of small buildings	1. Inadequate or inappropriate incentives from utilities 2. High audit costs 3. Diverse and scattered energy services and customers

Other possible stakeholders include building supply and equipment manufacturers; architectural and engineering design firms; state, local, and federal policy makers; building codes and standards developers; researchers; and consumers of small business goods and services. This report does not focus on these audiences.

PGL also identified key stakeholders that include organized business districts with professional staff, such as business improvement districts, local service areas, downtown associations, and historic districts. These stakeholders are important in the effort to develop energy efficiency solutions, because district- or neighborhood-level aggregation is an effective way to enable economically scalable energy efficiency strategies (PGL 2013).

For example, some organized business districts provide resources and technical assistance to help revitalize downtown and business districts and advance economic development (PGL 2013). Improving energy efficiency can be an effective economic development strategy.

3.3 Needs and Opportunities

The SBSP sector has great potential for energy cost savings and job creation, and small building and business owners frequently express interest in energy efficiency; however, saving energy presents many challenges.

To better understand these challenges, NREL researchers reviewed reports and engaged in telephone conversations with key players. During the interviews, researchers recorded opinions about sector needs as well as the interviewees' recommended approaches for increasing energy savings, as summarized here.

1. Policy and programs:
    a. Establish federal, state, and local long-term energy plans (Higgins 2012).
    b. Streamline access for owners and third-party service providers to participate in energy efficiency programs (Higgins 2012).
    c. Simplify regulatory requirements and accelerate the regulatory process to reduce costs and increase certainty that energy projects will be approved (NSBA 2012).
    d. Work with building energy management programs to develop criteria for small buildings (Malin 2012).
    e. Work with professional appraisal groups to develop recommendations and guidelines to help appraisers identify and value high-performance building features (Finlay 2013).
    f. Partner with trusted organizations or local entities to increase participation and reduce costs (Higgins 2012).
2. Financial incentives and enhancements:
    a. Provide a clear pathway for tax credit documentation. Tax credits can be difficult for small businesses to document (Malin 2012).
    b. Provide financing at attractive rates.

c. Encourage credit enhancements such as SBA loan guarantees and other mechanisms (Finlay 2013).

d. Quantify the value of energy efficiency improvements beyond cost savings (increased property value, appeal to prospective tenants, etc.) (Finlay 2013).

e. Clearly define risks of investing in energy efficiency solutions (Finlay 2013).

f. Establish utility energy efficiency power purchase agreements (PPAs) at rates on par with generation to encourage new delivery models from suppliers that would reduce the process costs to building owners (Higgins 2012).

g. Encourage utilities to invest on the customer's side of the meter to save measurable energy and to achieve a regulated rate of return (PGL 2013).

h. Develop affordable small building audits and determine ways to increase participation rates (Parker 2012).

3. Data analysis, tools, and delivery of energy efficiency solutions:

   a. Aggregate or bundle sets of buildings to create energy savings and economic momentum to develop a stronger business model for whole-building retrofits through reduced transaction costs and the ability to leverage services and solutions (Higgins 2012).

   b. Establish coordinated programs that implement large-scale aggregated information to capitalize on the long-term, stable rates of return from energy conservation investments on the customer's side of the meter (PGL 2012).

   c. Simplify the delivery of energy services by enhancing and expanding third-party service provider models—contractors, energy service companies (ESCOs), and owner consortiums (Higgins 2012).

   d. Support incremental improvements that can be made in conjunction with major renovations and equipment upgrades or replacements. This will produce cumulatively greater energy and dollar savings than waiting to undertake the whole job until much later (Cassidy 2012a).

   e. Develop tools for better control of buildings, including plug load management based on behavioral science, heating and cooling requirements, and lighting (Cassidy 2012b).

   f. Support metering and submetering projects during renovations of small buildings (Cassidy 2012b).

   g. Encourage further development of a national data standard for exchanging meter-level data for multiple fuels (PGL 2012).

   h. Develop building analysis tools or software applications for utilities to analyze individual and aggregate utility bills (Malin 2012).

4. Energy efficiency technologies:

   a. Support research and development on building equipment (Malin 2012), especially energy-efficient equipment sized for small buildings and businesses.

b. Work with ASHRAE to approve smaller equipment for commercial applications (Malin 2012).

NREL researchers used this stakeholder feedback to identify and inform DOE's unique role in this effort, to develop a list of potential DOE focus areas (see Section 4.2), to support widespread adoption of energy efficiency across the SBSP sector, and overcome barriers.

4 Small Buildings and Small Portfolios Report

The goal of this report is to identify approaches and strategic priorities for DOE to pursue in the SBSP sector for the next 3–5 years. Based on the detailed analyses summarized in this report, NREL researchers assembled data, research, and opinions from key stakeholders and identified high-priority areas (see Section 4.2) for DOE to focus its efforts. These potential focus areas address research, development, and evaluation; demonstrate scalability; include a deployment plan; and provide pathways for analysis and tools to apply to policy, codes, and energy efficiency incentive programs.

NREL researchers evaluated and sorted the data compiled in Section 3 into potential research areas, and coupled these research areas with example projects. Then, they reviewed and evaluated current DOE and national laboratory projects for potential inclusion in the SBSP report. Section 4.3 lists current projects that NREL researchers determined should be expanded, along with new research areas to pursue over the next 3–5 years.

4.1 Report Development

NREL researchers analyzed the SBSP sector to answer the following key questions based on the research conducted for the development of this report.

- Does the SBSP sector need additional support for energy efficiency solutions?
- Is the energy savings potential significant?
- Is DOE's unique role required?
- Is the cost of conserved energy competitive with that offered through competing projects?
- Are non-DOE project development and deployment partners sufficiently committed?

Does the SBSP sector need additional support for energy efficiency solutions?

Section 3 provides an evaluation of the SBSP sector that identifies overall needs and opportunities for encouraging significant energy savings. Given the current status of the sector, the need for market intervention is clear and DOE roles are well defined.

The fragmentation and complexity of the SBSP sector have historically created many barriers. Of these, limited capital, lack of time to research and implement, and lack of available sector-specific resources and technologies are particularly significant (NSBA 2011). Despite these barriers, small building and business owners are becoming increasingly interested in energy efficiency. As noted in Section 3, 52% of surveyed NSBA members said they were very concerned (40% were moderately concerned) about future energy costs. However, although awareness of government- and utility-backed energy efficiency programs has increased over the past couple of years, only 27% of surveyed businesses have actually used them and 37% did not know about them (NSBA 2011). Only 5% of surveyed businesses have participated in utility-sponsored on-bill financing programs to upgrade or retrofit their businesses (NSBA 2011). This gap between interest and action is a strong indicator of a market failure and of a need for additional support for energy efficiency.

Is the energy savings potential significant?

The opportunity for energy savings in the SBSP sector is great. Assuming a maximum potential energy savings of 45%, derived by data presented in the AERGs (DOE 2012), the small buildings sector could save 1.07 quads of site energy, or $30 billion, annually (PGL 2013). In 2011, this represented 6.6% of energy consumed by all U.S. residential and commercial buildings
(PGL 2013).

Is DOE's unique role required?

DOE has the ability to encourage a vast increase in energy savings across the SBSP sector over the next 3–5 years. DOE could help remove barriers by providing national leadership, objective information, and innovative tools, technologies, and services that encourage the SBSP community to take action in areas where current solutions do not meet the needs. (Section 4.2 lists potential DOE activities.) These activities could promote analysis of energy use and development of energy efficiency measure (EEM) packages for specific small businesses, small building types, and climate zones.

Is the cost of conserved energy competitive with that offered through competing projects?

At present, the cost of conserved energy for small building owners is likely to be significantly higher than that of other market sectors, because they often lack the purchasing power to obtain volume cost discounts, and the ratio of transaction costs to energy cost savings tends to be significantly larger for small retrofit projects. However, investment in resources tailored to the unique needs of the SBSP sector can reduce transaction costs, minimize risk, and increase confidence in the success of energy efficiency projects. This can have a dramatic impact on the cost effectiveness of building retrofits. Investment in resources and tools for the SBSP market can have a very low cost of conserved energy because huge energy savings can be achieved through targeted research and deployment efforts.

Are non-DOE project development and deployment partners sufficiently committed?

Traditionally, the most experienced and qualified ESCOs have avoided the SBSP market because of the high transaction costs and limited energy cost savings. However, many utilities have launched initiatives that are designed to break through the barriers and stimulate greater movement toward energy efficiency in this market. Organizations such as the National Trust for Historic Preservation and the NSBA have also stepped up their efforts to catalyze increased activity among small building owners. In contrast to the "large account" approach used in recent years to transform the commercial building market, DOE will need to collaborate with smaller and less traditional (but no less committed) SBSP partners.

4.2 Potential Roles for DOE and Potential Collaborators

NREL researchers aggregated and evaluated the data presented in this report to identify sector-specific needs and qualitatively determine potential high-priority areas for DOE (see Table 5). These areas were highlighted during the peer review process, and feedback on their importance and priority was incorporated into the final recommendations.

Table 5. Potential High-Priority Areas of Exploration for DOE and National Laboratories To Pursue in the SBSP Sector Over the Next 3–5 Years

DOE/ National Laboratory Role	Project Type	KEY FOCUS AREAS	Potential Topics for Exploration
Research, development, evaluation, and demonstration	Tools and technical guidance	1. Encourage submission to DOE's open, interactive energy datasets and platforms to address the lack of benchmarking data and enable owners, utilities, and financiers to identify the best energy savings opportunities for small buildings (SHORT TERM PRIORITY)	• Coordinate programs that implement large-scale information gathering on energy use patterns • Develop tools for utilities and financiers to analyze aggregated utility bills and building energy data by small building type/business type/ climate zone and identify high priority markets • Develop EEM packages for specific small building and business types that correlates energy savings uncertainty with the level of EEM package sophistication • Estimate the capital needed from different sources to deliver the maximum, cost-effective energy conservation at different points in the building life cycle for specific small building types • Develop design and retrofit guides to improve design, procurement, and implementation of EEMs in small buildings (potentially merge with tool for EEM packages)
		2. Enable small building owners and third-party service providers to make solid investment decisions at the building and district levels by developing simple tools that enhance energy audit and loan application processes for small buildings, overcoming high transaction costs and lack of owner expertise. (SHORT TERM PRIORITY)	
		3. Characterize and support third-party service providers so they are better aligned with design resources and incentive programs (SHORT TERM PRIORITY)	
	Equipment and controls	4. Engage and incentivize manufacturers and contractors to produce and install high-efficiency equipment, controls, and other technologies that are appropriate for small buildings (LONG TERM PRIORITY)	• Engage existing manufacturer focus groups or energy forums • Support research and development on lower capacity building equipment and develop a product design challenge similar to the RTU Challenge • Develop building tools or widgets for analyzing or controlling energy use in individual small buildings.
Deployment	Pilot program	5. Provide greater confidence that energy efficiency investments will be successful for small building owners by proving cost-effectiveness of the investments through demonstration projects and case studies that include detailed cost data and performance verification (LONG TERM PRIORITY)	• Support a pilot program that focuses on a specific building and business type and climate region, to collect actual data on actual building performance • Support a pilot program that focuses on large-scale information gathering
Policy efforts, codes, incentives	Organizational guidance	6. Help remove organizational and administrative barriers by identifying or developing SBSP-specific guidance and materials that address barriers such as cumbersome tax credit documentation and split incentive obstacles (SHORT TERM PRIORITY)	• Provide guidance for incorporating energy efficiency into small building leasing and building appraisals. Provide guidance on better distributing energy efficiency responsibilities to tenants and owners • Provide a clear path forward for using tools that will automate tax credit documentation and help identify EEM packages for small buildings
	Policy, codes and standards, and incentive programs	7. Help make the SBSP community more energy efficient by establishing sector-specific, long-term energy goals and research priorities (LONG TERM PRIORITY)	• Identify long-term energy goals at the federal, state, and local government levels. A clear plan should be in place to deliver the tools and resources needed by small buildings when these opportunities for improvement arise.

Table 5 excludes many needs in the SBSP community, because they are broader issues that affect large and small buildings. However, many are addressed by the focus areas derived from current research and the proposed framework for new construction (NREL 2013). The new construction high-priority focus areas include:

1. **Benchmark data:** System- and whole building-level benchmark data, organized by building type and climate, that can be used to set performance targets for new buildings
2. **Better modeling tools:** New and enhanced modeling tools to support integrated design, analysis of new technologies, and identification of operational and behavioral influences on energy use

3. **Model code language:** Model code and stretch code language that can be adopted by states and localities seeking more aggressive energy performance and data disclosure requirements
4. **Better cost data:** Objective, vetted average component- and system-level cost data for analysis of return on investment
5. **Commissioning and operational strategies:** Effective commissioning and operational strategies following hand-off, demonstrated through case studies
6. **Integrated resources:** Integrated resources that present new construction case studies, best practice guides, datasets, and tools in a more accessible, adaptable, and user-friendly format.

4.3 Potential Program Improvements and New Approaches

The following program areas are either an expansion of existing programs, or new approaches that specifically address the unique challenges of the SBSP sector. The key focus areas, as defined in Table 5, are indicated in parentheses.

- **Standard low-risk retrofit packages for small buildings (1,2):** DOE could partner with utilities and financial institutions to gather and provide more transparent performance data for EEMs. These data would also be used to develop standard packages of retrofits adapted to small buildings with limited ability to perform detailed audits. These packages would be supported by simple decision trees that can be navigated without detailed information about the performance of existing building systems. The packages would be designed to help evaluate economic and risk criteria defined by the financing partners, including average energy cost savings, percent of buildings that would achieve positive cash flow from the investment, projected life cycle of energy savings, and net present value.
- **SBSP Retrofit Database (1,2,5):** DOE could encourage the collection of data for the Building Performance Database (BPD) with information about retrofit measures completed in small buildings. The BPD would help motivate other building owners to initiate their own retrofit projects by allowing them to see the successful actions others have taken in similar situations.
- **Better Buildings Main Street Program (1,2,5):** DOE could form a new partnership with a diverse group of SBSP stakeholders that would help to plan, design, and demonstrate research, tools, and resources that are targeted to local business communities. In addition to several energy champions representing small building owners and occupants, the program would include organized business districts with professional staff such as business improvement districts, local service areas, downtown associations, and historic districts. Local business communities offer a unique opportunity because the buildings tend to be older and the building owners and tenants are often interested in working cooperatively toward a common goal.
- **AERGs for small buildings (1,2,3,6):** DOE could develop short AERGs tailored to the SBSP market, with simplified step-by-step guidance, low-risk standard packages, and helpful case studies to stimulate ideas. (The published AERGs are more appropriate for

energy managers of larger buildings, who have a base level of expertise in energy systems and efficiency improvements.) This activity would address the need for better retrofit guidance adapted to the needs of the SBSP market.

- **SBSP fact sheets (2,3,6):** In conjunction with the AERGs, DOE could develop a series of two-page fact sheets with simple guidance for specific small building types, including no-cost operational improvements, retrofit measures to consider, links to additional resources, and short case studies. These fact sheets would not be supported by detailed analysis, but would instead draw on the experience of industry practitioners to identify the most common techniques for reducing energy use in small buildings. The building types could range from the most common (small offices, corner stores, mom and pop restaurants) to those that are less common but have high energy intensity (machine shops, laboratories, dentists' offices).
- **Training curriculum for energy service providers (2,3):** DOE could leverage past and current work developing audit tools, educational materials, and best practice guides to create a special training curriculum for energy service providers that support small businesses. The training would focus on balancing affordability with accuracy, resulting in audit recommendations that are simple, safe, and cost effective. DOE could enlist organizations to pilot the training curriculum with its smaller members.
- **Advanced equipment challenges (4):** Expanding on the successful RTU Challenge, DOE could sponsor additional contests to encourage thinking outside the box and reward innovation by manufacturers of smaller capacity heating, ventilation, and air-conditioning (HVAC) equipment and inexpensive building controls. This effort would address the need for greater collaboration with manufacturers, and the market need for higher performance HVAC systems sized for smaller building loads.
- **Advanced controls in the small building sector (4):** Most small buildings do not have central building automation systems, so the advanced efficiency control options—to which larger buildings have access—are limited. As a result, novel, inexpensive control concepts that can be implemented without a central building automation system must be developed, integrated, and demonstrated. Control concepts that could be addressed include dimming of electric lighting, occupancy control, smart thermostats, daylight harvesting control capabilities, and variable frequency drives for pumps and fans.
- **Simple online analysis tool (4):** DOE could adapt existing tools, such as the Home Energy Saver, Asset Score, and other similar tools, to include small commercial buildings. For example, the Home Energy Saver helps homeowners perform prescreening to determine whether their homes are good candidates for energy retrofits. It also provides preliminary estimates of savings potential, and suggests priority measures for consideration based on a few simple inputs about the features of the house, climate, and utility bills. Adapting this and other similar DOE tools could be beneficial to the SBSP sector. The sophistication level of most small commercial building owners about energy savings opportunities in their buildings is similar to that of homeowners, so they would value simple screening tools such as these before investing in an energy audit.
- **Better Buildings Challenge (5):** DOE could initiate direct partnerships with several small building owners, or organized consortia to better understand the practical

challenges facing the SBSP market and develop case studies that would stimulate action by increasing confidence in the opportunities. Partners would be encouraged to provide detailed cost data for all aspects of the projects, allow access to all phases of the decision-making process, and help DOE measure and verify actual energy savings. This activity would lead to better cost data, improve the guidance documents, and support the definition of standard, low-risk EEM packages.

4.4 Program Coordination and Implementation

This report emphasizes key focus areas that could accelerate the adoption of energy efficiency solutions across the SBSP sector. It recommends a broad-based approach that balances innovation, technology, policy, market, strategic deployment, and economic considerations. Highly motivated and knowledgeable stakeholders would likely be the early adopters, influencing the pace of awareness and acceptance; others will require additional information or incentives before acting. Lessons learned from the successes and failures of early adopters from start to finish must be communicated to reach hesitant or risk-averse audiences.

The strategy for achieving SBSP goals should focus on three phases of the program management process: (1) development, (2) demonstration, and (3) deployment. A logical progression through each phase should steadily increase the scale of energy efficiency solutions across the SBSP sector, broadening market penetration. Completion of each SBSP program phase should be validated using a stage-gate process with specific go/no go criteria (see Figure 6).

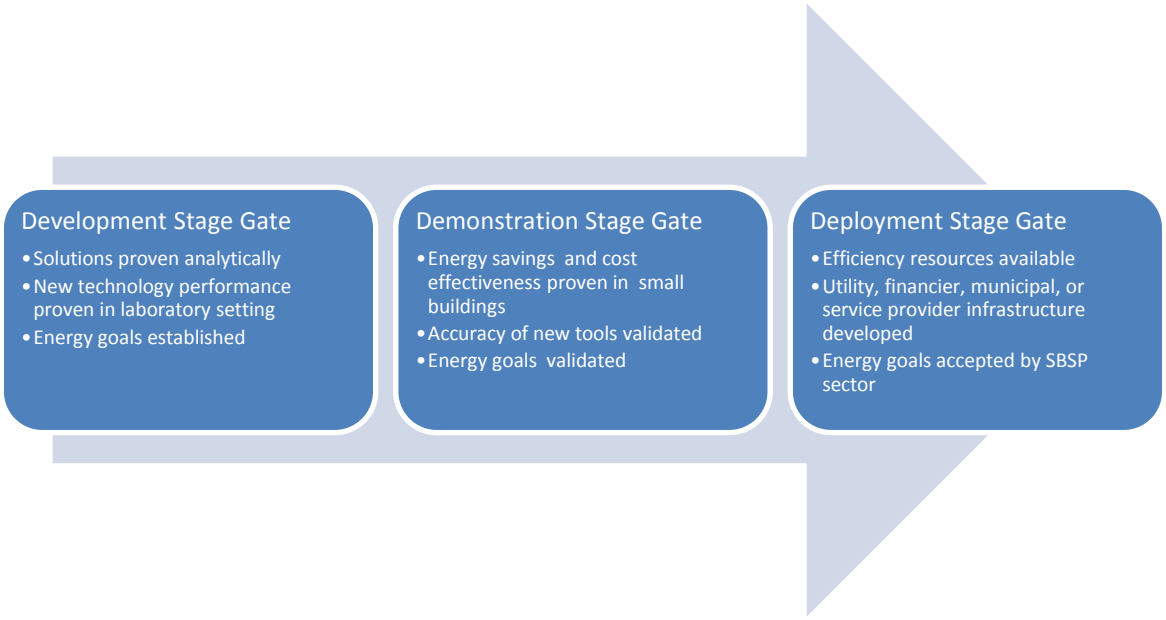

Figure 6. SBSP stage-gate process

The stage-gate process will be conducted independently for each SBSP project, and schedules and milestones will be project specific.

4.5 Communication and Outreach Approach

A communication and outreach approach has been developed to engage organizations and expert stakeholders in relevant aspects of the report. Its goals are to increase the impact of the recommended key focus areas (see Table 5) and broadly disseminate the results.

This approach includes a framework to support effective and coordinated communication that supports the key focus areas for the next 3–5 years. It also provides guidance for all communication activities that are necessary to build capacity and engage interagency and nongovernmental expert stakeholders.

4.5.1 Goals and Objectives

To successfully reach target audiences in the SBSP sector, the communication approach should:

1. Increase awareness of the key focus areas by maximizing interagency and nongovernmental stakeholder relationships and developing new stakeholder partnerships.
2. Ensure that interagency and nongovernmental expert stakeholders understand the focus areas outlined in the report.
3. Mobilize key stakeholders to enhance current efforts that promote energy efficiency solutions.

The communication approach should also implement creative, cost-effective, and impactful communication and outreach strategies and techniques that engage stakeholders. It should:

1. Leverage communication tools and networks to engage priority stakeholders.
2. Achieve coordinated communications, both internally and externally, by developing key messages and talking points to establish "one clear voice" in all communication channels and all stakeholder audiences.
3. Enable key stakeholders to communicate information to the SBSP sector.
4. Engage representatives from national, state, and local organizations in implementing communication and outreach strategies.
5. Establish strong, positive connections between DOE, stakeholders, and their communities.

This approach will lead to measurable outcomes that are expected to include:

1. Increased number of new partnerships with key stakeholders
2. Increased capacity and influence of key stakeholders
3. Increased awareness and knowledge of opportunities for implementing EEMs.

4.5.2 Framework

The communication and outreach approach focuses on interagency and nongovernmental expert stakeholders, including building owners, tenants, third-party service providers, utilities, financiers, municipalities, and small business associations. These stakeholders recognize that

DOE is well positioned to develop an infrastructure that promotes technical innovation and economic change to meet sector-specific energy efficiency needs. Successfully reaching these stakeholders will require the following key activities for efforts related to the key focus areas:

1. Identify and prioritize interagency and nongovernmental expert stakeholders.
2. Identify key actions for stakeholders to take.
3. Develop key unified, consistent, and actionable messages related to DOE focus areas and establish a plan to keep the messages fresh.
4. Identify and use the best communication channels to maximize awareness and support among primary stakeholders.

4.5.2.1 Identify Target Audiences

The communication approach has two main audiences: (1) interagency and nongovernmental expert stakeholders; and (2) building owners, tenants, third-party service providers, utilities, financiers, municipalities, and small business associations.

4.5.2.2 Develop Key Messages

Success in any communication initiative requires well-defined and effectively communicated key messages. These messages should be consistent with the desired outcome of each initiative under the key focus areas proposed in this report.

The Communications team will work with key stakeholders to develop simple, direct messages that address their issues and concerns (see Appendix A). Example messages might include:

- Small buildings offer big opportunities for energy savings.
- Saving energy is good for business.
- DOE helps small building owners and businesses thrive through energy efficiency solutions that reduce operating costs.
- Aggregating small buildings in neighborhood districts or by other means can increase impact and provide opportunities for scalable energy savings (across a neighborhood district, for example).

4.5.2.3 Select Communication Channels

Communication channels carry the messages to the target audiences. Creative, low-cost, and impactful communication and outreach approaches and strategies reach and engage stakeholders in a way that encourages them to take action. These may include:

- **Events:** Attend targeted industry events and promote and encourage stakeholder participation.
- **Web page:** Develop a central online location for information, tools, and resources on the DOE Energy Efficiency and Renewable Energy (EERE) website.
- **Fact sheet:** Create a quick overview of the SBSP report and DOE efforts, located on the EERE website.

- **Webinar series:** Provide live online webinars to engage target audiences and share information that is replicable, useful, and actionable. Webinars will be archived.
- **Web postings:** Keep Web content fresh and encourage target audiences to use it by driving traffic to the website.
- **eBlasts:** Deliver fresh content and messaging that can also drive traffic to the website.
- **Prezi:** A cobranded, integrated, automated presentation that stakeholders can use to support their energy efficiency efforts.
- **Newsletter placement:** Drive traffic to the website and other Web tools and increase target audience awareness.
- **Article placement:** Drive traffic to the website and other Web tools and increase target audience awareness.
- **Community toolkit:** Develop an integrated package of essential communications tools to enable stakeholders to easily share and spread key messages throughout their communities.
- **Case studies:** Tell real-world stories that provide insights and inspiration to help stakeholders successfully implement energy-saving technologies and demonstrate their results.
- **Partnerships:** Develop national, state, and local partnerships to share information, resources, and support.
- **Level of effort:** Develop a system for determining the level of communication efforts (see Figure 7).

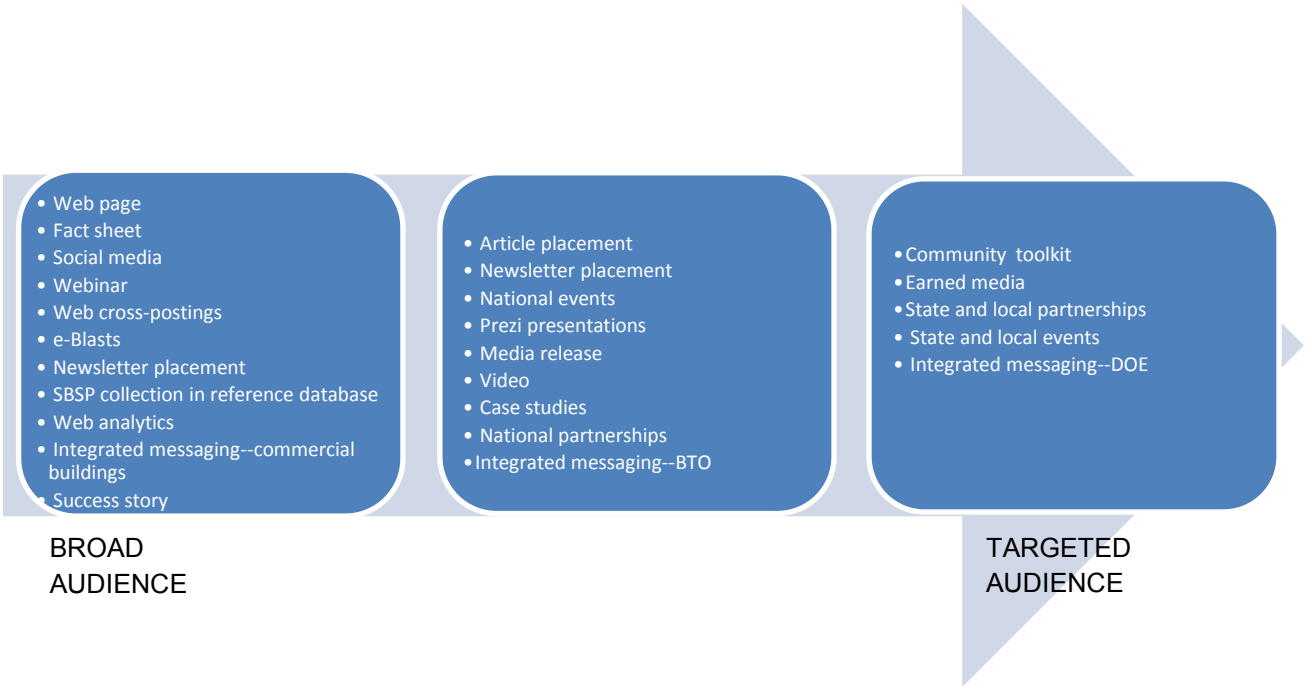

Figure 7. Levels of communication effort required for desired results

4.5.3 Progress Evaluation

A communications plan is a living document and should be reviewed and amended regularly. Metrics help managers determine whether the communications plan is meeting its stated objectives and should identify opportunities, successes, and needed improvements.

Measurement techniques might include:

- Analytics and Tracking
    - **eBlasts:** Number of times the email is opened and the number of times it is forwarded or shared.
    - **Usability studies:** Page views, lengths of visits to page, shares, new visitors, etc., tracked and assessed using Web analytics for all related Web resources.
    - **Webinars:** Total number of registrants and participants. If the webinar is archived, track the number of times the webinar has been accessed.
    - **Web page:** Website page views, time spent on page, downloads, and shares.
    - **Fact sheet:** Number of downloads and shares.
    - **Events:** Number of participants.
- Increased Stakeholder Awareness
    - Number of engaged and active stakeholders.
    - Increase in number of stakeholders and reach of new partnerships.

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Appendix A: SBSP Sector Characterization

Information in Appendix A is provided as additional data supporting Section 3 through Section 3.2.

NSBA (2011) conducted an energy survey to understand energy efficiency concerns of small business owners and operators and learn about the approaches small businesses took to save energy. NSBA gathered information from more than 200 members. Of those, 40% cited limited cash flow as the primary obstacle to making their businesses more energy efficient; 20% identified lack of time to research and implement energy efficiency solutions; and 9% and 8% mentioned a lack of resources and available technologies, respectively. Of the businesses that chose "other" in this survey, the most common responses were the poor economy, the fact that they lease their facilities, and a lack of time. The findings are summarized in Table A–1.

Table A–1. NSBA 2011 Energy Survey—Main Obstacles Preventing Small Businesses from Becoming More Energy Efficient

Obstacle	Survey Results (% of Affirmative Responses)
Cash flow	40%
Lack of time to research and implement	20%
Other	14%
Lack of resources	9%
Don't know	9%
Available technology	8%

The NSBA also collected data from all members surveyed on the most common steps they took to reduce energy consumption. Table A–2 lists a few of the most important.

Table A–2. NSBA 2011 Energy Survey—Most Important Energy-Saving Steps Taken by Small Businesses

Action	Survey Results (% of Affirmative Responses)	Building End-Use Category
Switch off lights/equipment when not in use	36%	Controls
Purchase new, more efficient equipment	33%	Equipment
Change thermostat	31%	Controls
Upgrade to more efficient lighting	29%	Lighting
Change work schedules or operating hours	16%	Operation
Add insulation	11%	Envelope
Install new windows and/or doors	11%	Envelope
Upgrade maintenance of equipment	9%	HVAC
Other	6%	Other
Improve ventilation	6%	HVAC
Install/improve heat-recapture system	3%	HVAC

Primary energy costs were also recorded. From the survey, 31% cited heating and cooling as primary energy costs for their businesses (NSBA 2011). Nineteen percent reported that operating equipment was a primary energy cost, 6% were unsure or did not know, and 5% reported lighting as a primary energy cost (NSBA 2011). Energy cost increases have had mostly negative effects on the surveyed members' businesses. Businesses have responded to these increases as outlined in Table A–3.

Table A–3. NSBA 2011 Energy Survey—Reaction of Businesses to Rising Energy Costs

Action Taken by Small Businesses	Survey Results (% of Affirmative Responses)
Increased prices	43%
Reduced amount of business travel	32%
Reduced workforce	27%
Reduced energy through new company policies or programs	25%
Purchased new technologies with better efficiency	23%
Reduced employee benefits	14%
Changed or streamlined production process	11%
Limited production schedule	7%
Increased use of public transportation	3%

PGL (2013) conducted a study of nearly 800 small buildings in 10 U.S. markets and paired it with a market prioritization study and analysis of CBECS microdata. This study established a comprehensive building typology that identified seven primary building types to target as small buildings with a high potential for energy savings. PGL's research objectives were to identify specific types of small commercial buildings that offer opportunities for significant energy savings. The research also quantifies the relative magnitude of market influences that affect the adoption of energy-saving strategies and determines common characteristics and regional variations for the target building types that inform strategies to enhance the energy performance of small commercial buildings. Results from the research provide a characterization of the small buildings sector with descriptions of regional variations. The research also provides recommendations for strategies and approaches to maximize energy savings for the SBSP sector.

PGL (2013) collected and analyzed data to characterize the sector in three major steps:

1. Conducted an in-depth analysis of CBECS microdata to identify primary building types in the sector.
2. Worked with a third-party consultant to conduct a market prioritization analysis that identified ownership patterns, operation and maintenance practices, and available resources for market subsectors.
3. Conducted a national building survey that examined actual buildings and targeted each primary building type identified through the CBECS analysis. The surveyed data included physical characteristics, ownership information, and permit data.

PGL's analysis of CBECS microdata was used to estimate three main components of the small buildings sector:

- The total size of the small buildings sector
- The relative size of each building type in the entire commercial sector and in the small buildings sector
- The energy consumption of the entire commercial sector, the small commercial buildings sector, and each building type.

This study excluded some building use types because either: (1) their physical characteristics were deemed too diverse in to allow building-type definition; or (2) their market share was too small. These building types should, however, be considered in future DOE projects. Included and excluded use types are listed in Table A–4.

Table A–4. Primary Use Types Included and Excluded in the CBECS Data Analysis by PGL

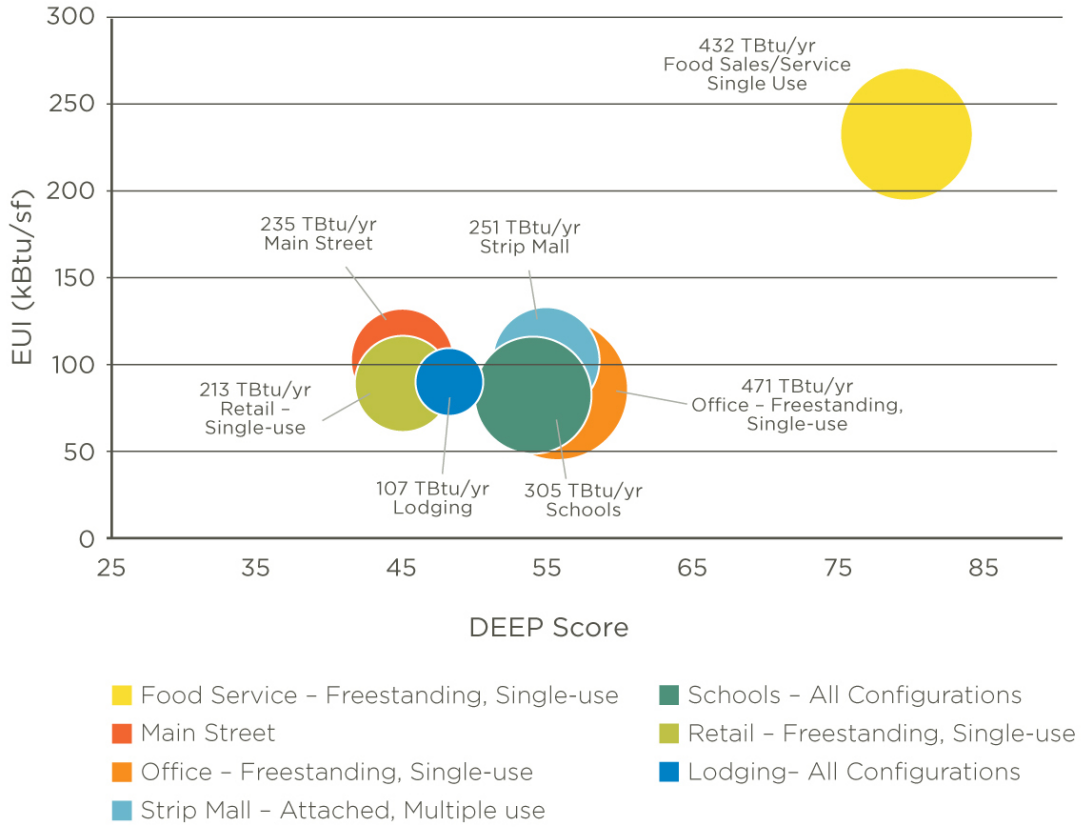
Included Use Types	Excluded Use Types
Education	Healthcare
Food Sales	Hospital
Food Service	Nursing Home
Lodging	Public Assembly
Office	Public Order and Safety
Retail	Religious Worship
Warehouse	Service
Mixed-Use	Shopping Mall

PGL conducted a market prioritization analysis with a third-party consultant to identify ownership patterns, operations and maintenance practices, and available resources for market subsectors (PGL 2013). This analysis used CoStar and McGraw-Hill/Dodge databases, relevant industry reports, and direct project experiences to study how owners, operators, occupants, energy management practices, maintenance practices, real estate market fundamentals, and energy costs influence the market.

To quantify the energy efficiency potential of these buildings, PGL developed a market assessment index called the DEEP (Deep Energy Efficiency Potential) Score. This index measures four principal indicators:

- **Energy density:** Annual energy use per building of the market segment
- **EUI ratio:** Ratio of average market segment EUI to national average EUI
- **Scale factor:** Ratio of the annual energy use of the market segment to the total national energy use for the commercial building segment
- **Market factor:** Rating of the potential for customer adoption of energy efficiency strategies for the market segment.

The DEEP Score is calculated by weighting each factor described above and adding all four together. The factors are weighted by 22% for energy density, 27% for EUI ratio, 25% for the scale factor, and 26% for the market factor (PGL 2013). PGL's DEEP assessment of the small commercial buildings market indicates that the subset of seven main small building types makes up 49% of all nonmall commercial buildings by number and consumes approximately one third of all energy use by nonmall commercial buildings. Table 3 provides the breakdown of energy use and share for each building type and Figure A–1 illustrates where each building type falls along the DEEP Score index. The DEEP Score index assembles the four components mentioned above onto a scale of 0 to 100, and ranks building types by their potential for achieving broad market acceptance for deep energy efficiency retrofits.

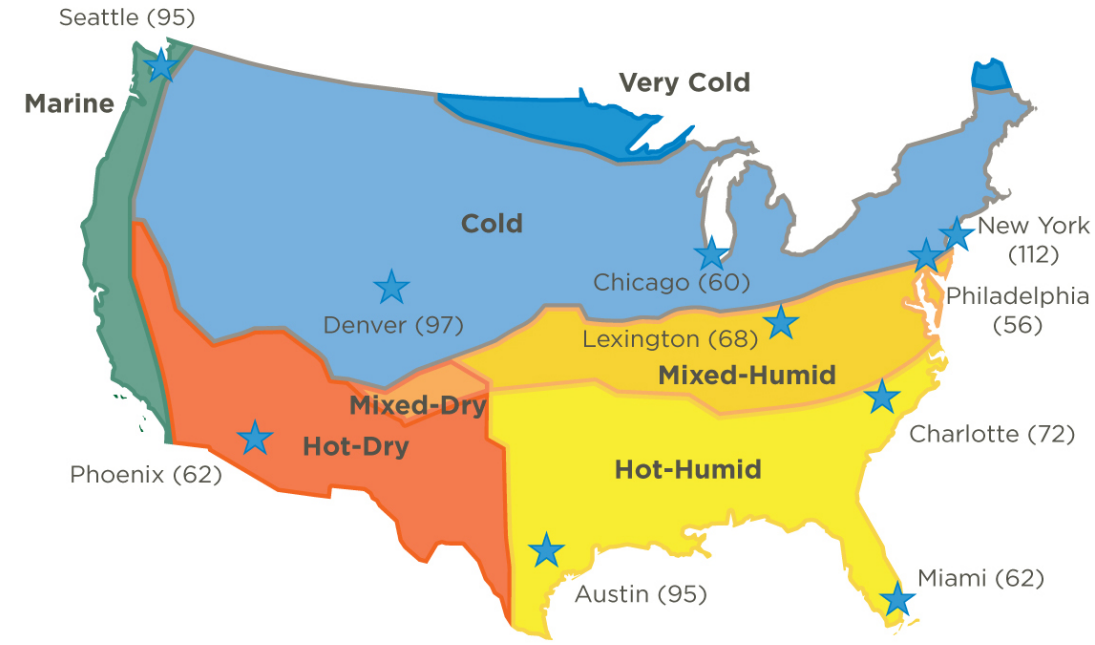


Source: CBECS 2003

Figure A–1. DEEP rating for PGL's target building types

(PGL 2013)

PGL used results from the CBECS and market prioritization analyses to conduct a national survey of nearly 800 buildings that targeted main street buildings (however, valuable information about all seven primary building types was obtained) in 10 cities across the United States. The cities and climate zones involved in this study are illustrated in Figure A–2.



Source: NREL Advanced Energy Retrofit Guide – Grocery (2012). Adapted from DOE

Figure A–2. PGL national survey cities and survey returns by U.S. climate zone

(PGL 2013)

In each submarket, a team of university graduate students, student coordinators, and faculty was organized to survey the buildings and answer several questions:

- What characteristics are common to each building type nationally?
- What characteristics can be determined that are not captured in CBECS data?
- What characteristics of buildings have the most regional variations?
- How do climate zones influence these regional characteristics?
- Which characteristics are most likely to influence energy consumption?
- What are the physical and legal characteristics of business districts?

The number of buildings and building types surveyed by PGL are summarized in Figure A–3. The surveys conducted by PGL's team consisted of approximately 100 questions that resulted in 73 discrete variables that were collected by accessing online building information (municipal data and Google Earth), a site visit, and permit history derived from municipal records (PGL 2013).

CLIMATE REGION	NUMBER OF BUILDING SURVEYS
Austin	95
Charlotte	72
Chicago	60
Denver	97
Lexington	68
Miami	62
New York	112
Philadelphia	56
Phoenix	62
Seattle	95
TOTAL	**779**

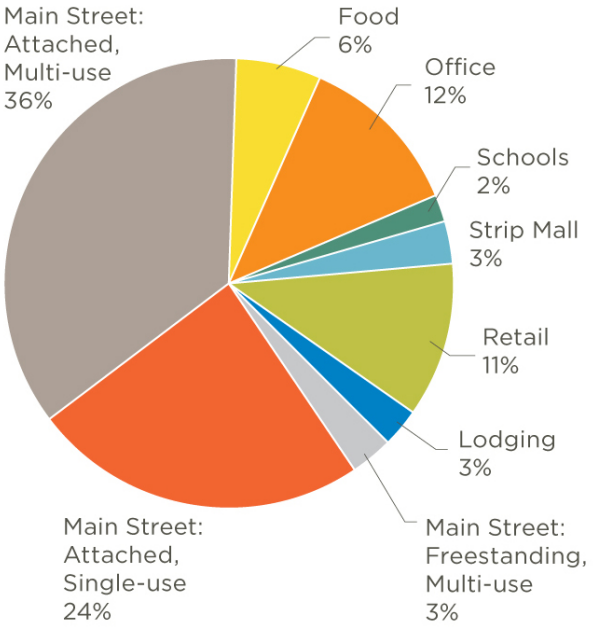


Figure A–3. National survey results by market and type

Results from the detailed sector analyses conducted by PGL presented seven major research findings that characterize the SBSP sector as noted in Section 3.1. Figure A–4 supports the research findings statement that most main street buildings were constructed before 1960.

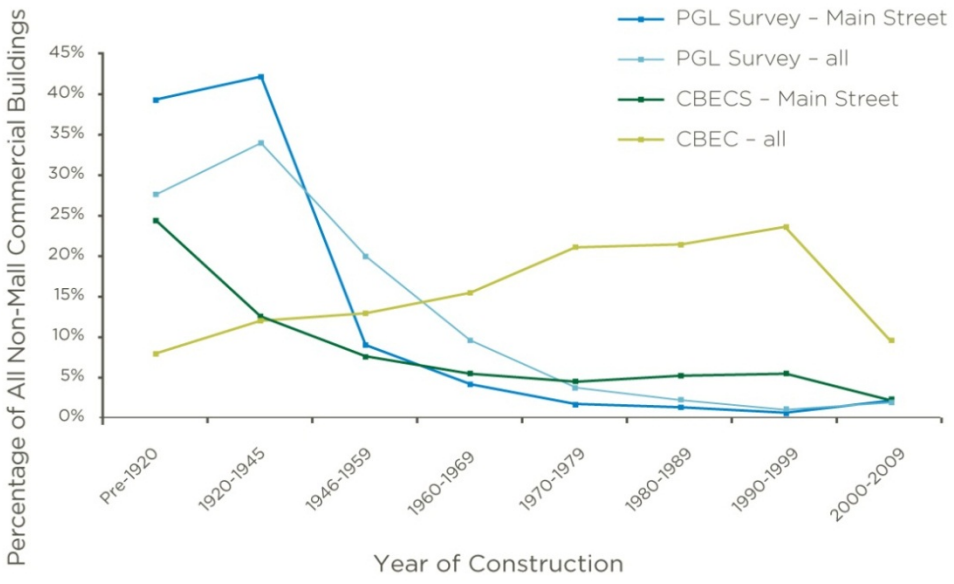


Figure A–4. Comparison of CBECS main street buildings with PGL national survey buildings

(PGL 2013)

Appendix B: National Needs and Opportunities

Information in Appendix B is provided as additional data supporting Section 3.3.

The fragmentation and complexity of the SBSP sector have created many historical barriers, although opportunities for achieving notable energy savings are significant. As previously stated, the sector accounts for 95% of the buildings and 51% of the floor space, and consumes more than 40% of the building energy used in the U.S. commercial building industry. PGL (2013) estimates that the small building sector consumes 2.8 quads of energy—47% of the national total for all nonmall commercial buildings. Assuming a maximum potential energy savings of 45%, derived by data presented in the AERGs (DOE 2012), the small building sector can potentially achieve 1.07 quads of annual site energy savings, or $30 billion in energy cost savings per year. The maximum potential savings may not be realistic in all cases, but this analysis illustrates the magnitude of the potential impact of a well-designed SBSP initiative. The energy savings potential for each primary building type identified by PGL is shown in Table B–1.

Table B–1. Estimated Energy Savings Potential for Each Primary Building Type Identified by PGL

(PGL 2013)

TARGET BUILDING TYPES	POTENTIAL COST EFFECTIVE SAVINGS	ANNUAL ENERGY USE (TBTU)	EUI (KBTU/SF)	POTENTIAL SAVINGS – LOW (TBTU)	POTENTIAL SAVINGS – HIGH (TBTU)
Food Service – Freestanding, Single-use	27% - 45% (PNNL 2010) (NREL 2012)	432	233	117	194
Main Street – All Configurations	27% - 59% (PNNL 2010) (NREL 2012)	235	105	63	139
Strip Mall – Attached, Multiple use	38% - 59% (PNNL 2010)	251	104	95	148
Lodging – All Configurations	20% - 30% (Energy Star)	107	91	21	32
Retail – Freestanding, Single-use	38% - 59% (PNNL 2011)	213	89	81	126
Office – Freestanding, Single-use	33% - 53% (PNNL 2011)	471	86	155	250
Schools – All Configurations	30% - 50% (ASHRAE 2011)	305	83	92	153
All Selected Building Types		2,014	105	625	1,042

Sources: PNNL Advanced Energy Retrofit Guides (various);
NREL Advanced Energy Retrofit Guide – Grocery (2012);
Energy Star website; ASHRAE Energy Efficiency Guides for Existing Commercial Buildings (2011)

Opinions about needs and recommendations for approaches to increase energy savings were collected through reports and telephone conversations with key members. PGL's analysis identified three major strategies to encourage significant energy savings across the sector. Those strategies are summarized in Table B–2.

Table B–2. Strategies for the SBSP Sector Identified by PGL Research

Strategy	Recommended Action	Potential Projects
Identify waste, measure results	To realize the full energy-saving potential of small buildings, energy policymakers must support solutions that measure, motivate, and monetize real energy performance.	Quantify the national impacts of conservation investments Create the data network necessary for measuring energy savings Communicate the economic value of eliminating energy waste Tie energy standards to measured performance Transform the market through leadership and performance
Plan for improvement	To optimize energy efficiency in small buildings, investors must align the timing of energy-saving improvements with natural opportunities in the building life cycle, such as time of purchase, operational initiatives, regular renovations, emergency and scheduled maintenance, and the ultimate sale of the asset.	Recognize the full value of energy-efficient buildings Make energy opportunities transparent between owners and occupants Create partnerships that support the needs of small businesses and building owners
Align new business models behind solutions that scale	To capture energy savings from the millions of diverse businesses in small buildings, new business models for energy efficiency must respond to compatible regulations, motivated and organized customers, and products whose time has come.	Support private and public sector research and development that implements information gathering at scale across utility jurisdictions Create technical guidance for turnkey solutions for small buildings Encourage nationally coordinated programs and business models

PGL's analysis also identified potential stakeholders to engage in each recommended action. Identified stakeholders and details to each recommended action are noted in Table B–3 and Table B–4.

Table B–3. Key Actions for Stakeholders (PGL)

STAKEHOLDER ★ Primary ★ Supporting	DOE	National Labs	National Standards	Energy Regulators	Jurisdictions	Utilities	Industry Champions*	Technology Providers	Energy Service Providers	Government Lenders	Real Estate Associations	Business Associations	Small Businesses	Building Owners	Property Managers
STRATEGY 1: Identify Waste, Measure Results															
1. Quantify the national impact of conservation investments:															
a. Analyze the aggregate impacts on U.S. and state employment, GDP, mineral reserves, and carbon emissions of gradually replacing existing generation and distribution resources with energy savings generated through conservation investments.	★	★													
2. Create the data network necessary to measure energy savings:															
a. Promote the ongoing development of a strong national standard that makes business-level energy data seamlessly available to utility customers, regulators, jurisdictions, financiers, and service providers.	★	★	★	★	★	★	★								
b. Invest in the further research and development of technologies that measure energy savings in new and existing buildings and that are compliant with the International Performance Measurement and Verification Protocol for establishing whole building energy performance.	★	★				★	★	★							
c. Assure customer data privacy and security compliance with Fair Information Practice Principles.			★	★	★	★	★	★							
3. Communicate the economic value of eliminating energy waste:															
a. Provide guidance to local energy regulators, utilities and jurisdictions that defines the benefits and costs of measuring the energy used by buildings and paying for realized energy savings.	★	★					★						★	★	★
4. Tie energy standards to measured performance:															
a. Promote solutions to measured energy use in the development of international model codes that are acceptable and cost effective for small building owners and businesses.	★	★	★	★	★		★				★	★			
b. Develop energy use targets for currently regulated and unregulated loads in both new construction and existing buildings, recognizing the distinct physical and market characteristics of existing buildings to save energy.	★	★	★	★	★										
5. Transform the market through leadership and demonstration:															
a. Create national guidance for federal, state and local Power Purchase Agreements (PPA) that contract for measured energy savings and that encourage the aggregation of savings across portfolios or districts of small buildings.	★	★	★			★			★						
b. Support a private market for energy conservation financing that is secured by utility PPAs for measured energy savings.	★	★		★		★	★	★	★	★	★	★			

Table B–4. Key Actions for Stakeholders (Continued, PGL)

STAKEHOLDER ★ Primary ★ Supporting	DOE	National Labs	National Standards	Energy Regulators	Jurisdictions	Utilities	Industry Champions*	Technology Providers	Energy Service Providers	Government Lenders	Real Estate Associations	Business Associations	Small Businesses	Building Owners	Property Managers
STRATEGY 2: Plan for Improvement															
1. Recognize the full value of energy efficient buildings:															
a. Establish a national standard for building energy labeling that is based on actual use and is tuned to the characteristics of small buildings.	★		★			★	★	★		★	★	★	★	★	★
b. Implement Small Business Administration, Federal National Mortgage Association (Fannie Mae), and Federal Housing Administration underwriting guidelines that require energy use disclosure on appraisals.	★					★	★	★		★	★				
c. Add criteria for energy evaluation to the professional guidelines and standards for tax assessors, appraisers and real estate brokers.			★			★	★	★		★	★				
2. Make energy opportunities transparent between owners and occupants:															
a. Collaborate with real estate professional associations to create standardized contract amendments for owners and tenants in small buildings that define the responsibilities, benefits, and costs of energy planning between landlords and tenants.	★		★				★				★	★			★
b. Estimate the capital needed from different sources to deliver the maximum, cost-effective energy conservation at different points in the building life cycle for each of the different types of small buildings.		★				★		★	★		★	★	★	★	★
3. Create partnerships that support small business and building owners:															
a. Leverage business districts and associations to convene energy planning workshops that include building owners, businesses, contractors, manufacturers, and utility advisors.						★	★	★	★		★	★	★	★	★
STRATEGY 3: Align New Business Models Behind Solutions that Scale															
1. Support R&D that implements information gathering at national scale:															
a. Encourage development of large data sets, essential to statistically significant models that can analyze energy use in small commercial buildings.	★	★	★			★		★							
b. Create open data platforms that share aggregated building characteristics across multiple utilities to encourage private investment in research, development, and commercialization.	★	★	★	★	★	★	★	★	★		★				
c. Continue support of standards for customer-specific data platforms that may remain closed and proprietary to encourage private investments in research, development, and commercialization.	★	★	★			★	★	★	★		★	★	★	★	★
2. Create turnkey solutions for small buildings and businesses:															
a. Recommend packages of 1) low and no cost operating strategies for businesses and for building owners, 2) retrofit measures that produce stable, long-term rates of return within small buildings that could be funded with long-term, external capital, and 3) maintenance strategies for small businesses.	★	★				★	★	★	★		★	★			★
b. Tailor the content of the packages to smaller general contractors, HVAC contractors, and electricians.						★	★	★	★		★	★	★		
3. Encourage nationally coordinated programs and business models:															
a. Support national pilot programs that integrate data collection, evaluation, implementation, and measurement and verification.	★	★		★	★	★	★	★	★		★	★			
b. Create innovative partnerships to deliver new sources of capital to energy conservation projects, including conventional and tax credit equity, as well as on- and off-balance sheet financing.				★	★	★	★	★	★	★	★	★			

**Industry champions: Private sector organizations conducting research, development, funding and public affairs to advance national and local energy conservation.*

Appendix C: Roles for Potential Collaborators

Roles for potential collaborators were also aggregated and evaluated. PGL lists primary and supporting roles of potential collaborators in Table B–3 and Table B–4 in Appendix B. NREL researchers also evaluated those and other roles recommended by key stakeholders through telephone conversations and reports on the sector. Those roles are noted in Table C–1 and Table C–2.

Table C–1. High-Priority Areas for National Standards, Tool Developers, Government Lenders, and Local Jurisdictions in the SBSP Sector

Project Type	Responsibility	Role	Source
Standards/codes	National standards	Promote the ongoing development of a strong national standard that makes business-level energy data seamlessly available to utility customers, regulators, jurisdictions, financiers, and service providers	PGL
Standards/codes		Ensure customer data privacy and security compliance with Fair Information Practice Principles	PGL
Standards/codes		Add criteria for energy evaluation to the professional guidelines and standards for tax assessors, appraisers, and real estate brokers	PGL
Tool development	Tool developers	Work with energy programs such as ENERGY STAR and Portfolio Manager to develop criteria for small buildings	Malin
Policy	Government lenders	Implement SBA, Fannie Mae, and Federal Housing Administration underwriting guidelines that require energy use disclosure on appraisal	PGL
Efficiency coordination programs	Local jurisdictions	Partner with trusted organizations or local entities to increase participation in energy efficiency solutions and reduce costs for small buildings	Higgins
Efficiency coordination programs		Provide financing options at attractive rates and use off-balance-sheet options such as Property Assessed Clean Energy, performance contracting, utility PPAs, and on-bill financing	Higgins
Efficiency coordination programs		Streamline access for owners and contractors to participate in energy efficiency programs	Higgins
Financing programs		Determine methods to reduce audit costs and increase participation rates	Parker
Efficiency coordination programs		Urban resources can be used to aggregate building upgrade strategies through policy and regulatory tools, political and cultural interest groups, and advantages of density	Higgins

Table C–2. High-Priority Areas for Energy Regulators, Utilities, and ESCOs in the SBSP Sector

Project Type	Responsibility	Role	Source
Standards/ codes	Energy regulators	Support a private market for energy conservation financing that is secured by utility PPAs for measured energy savings	PGL
Efficiency coordination programs	Utilities	Leverage business districts and associations to convene energy planning workshops that include building owners, businesses, contractors, manufacturers, and utility advisors	PGL
Guidance/ Deployment		Recommend packages of (1) low- and no-cost operating strategies for businesses and building owners; (2) retrofit measures that produce stable, long-term rates of return in small buildings that could be funded with long-term, external capital; and (3) maintenance strategies for small buildings	PGL
Training/ Deployment to Contractors		Tailor the content of the packages to smaller general contractors, HVAC contractors, and electricians	PGL
Financing programs		Create innovative partnerships to deliver new sources of capital to energy conservation projects, including conventional and tax credit equity, as well as on- and off-balance sheet financing	PGL
Regulatory requirements		Simplify regulatory requirements and accelerate regulatory processes to reduce costs and increase certainty; energy and environmental regulations often place a disproportionate burden on small businesses	NSBA
Utility program		Establish utility energy efficiency PPAs at rates on par with generation to encourage new delivery models from suppliers that would reduce the process and costs to building owners	Higgins
Utility program		Encourage utilities to invest on the customer's side of the meter to save measurable energy and to achieve a regulated rate of return	PGL
Efficiency coordination programs		Coordinate programs that implement large-scale information gathering	PGL
Equipment development		Support metering and submetering projects during renovation of small buildings	Cassidy
Delivery	Utilities/ ESCOs	Aggregate or bundle sets of buildings to create an energy-saving and economic momentum to make deep energy retrofits a stronger business model through reduced transaction costs and the ability to leverage services and solutions	Higgins
Pilot program		Develop pilot programs that package a range of buildings into a single delivery effort with low-interest capital for financing	
Delivery		Simplify delivery of energy services by enhancing and expanding third-party service provider models—contractors, ESCOs, and owner consortiums	Higgins
Training/ deployment to contractors		Support and expand third-party delivery, direct install, aggregators and full-market ESCOs to deliver increased savings to a much greater range of existing buildings	Higgins
Delivery		Support incremental improvements over time that can be made in conjunction with major events. This will produce cumulatively greater energy and dollar savings than waiting to undertake the whole job much later.	Cassidy

Appendix D: Web Page and Promotional Recommendations

To support the SBSP project, the NREL Communications Office recommends building a single or small number of "standard" Web pages for DOE's EERE website, which could be expanded at a later date

The NREL Communications Office recommends a basic approach in developing a website that will engage stakeholders and increase awareness of the SBSP initiative:

1. The Web page should reside on the EERE Commercial Buildings website.
2. Standard Web pages would include text and graphics (see Figure 2 and Table 5). The pages should include links to information about the projects, collaborators, and impacts/metrics.

The NREL Communications Office could help with activities, such as:

- **Content development:** Update and augment the website as the project reaches important landmarks.
- **Analytics:** Track statistics on the page via Google Analytics, and report results to the NREL research project lead in monthly or quarterly reports, as requested.
- **Project promotion:** Promote the SBSP initiative and activities through home page features, BTO news stories, and EERE corporate-level work (press releases, progress alerts, home page news stories), and posts to the EERE Facebook page (upon approval).
- **Search engine optimization:** Develop well-written content and identify key phrases and terms to ensure that the page appears foremost in popular Web searches.
- **Usability testing:** Conduct analyses to determine how page(s) are working for the audience.
- **Social media and other special features:** Use EERE tools, including blogs, newsletters, and widgets, to promote the SBSP website and initiative.