



Realizing the Energy Efficiency Potential of Small Buildings

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A REPORT BY:



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nbi new buildings
institute

RESEARCH PROJECT TEAM

NATIONAL TRUST FOR HISTORIC PRESERVATION (NTHP) PRESERVATION GREEN LAB (PGL)

Mark Huppert, Technical Director, PGL
Ric Cochrane, Project Manager, PGL
Patrice Frey, Director of Sustainability, NTHP
Jeana Wisner, Project Coordinator, PGL

NEW BUILDINGS INSTITUTE

Sean Denniston, Project Analyst
Mark Frankel, Technical Director
Dave Hewitt, Executive Director

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The market analysis and characterization of the small building sector (Part I) and many of the recommendations (Part II) presented in this report are

based on research and analysis that were conducted by PGL between 2009 and 2012 and have been generously funded by the Kresge Foundation, Doris Duke Charitable Trust, Bullitt Foundation, Boeing Corporation, City of Seattle, and numerous other supporters. The material presented in Part II under the headings “Key Actions” and “Stakeholders” contains data first created by PGL in performance of the contract with the Alliance for Sustainable Energy, LLC.

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ABOUT THE PROJECT PARTNERS

NATIONAL TRUST FOR HISTORIC PRESERVATION

(www.PreservationNation.org)

NTHP, a privately funded nonprofit organization, provides leadership, education, advocacy, and resources to save America’s diverse historic places and revitalize our communities. Recipient of the National Humanities Medal, the Trust was founded in 1949, and now has more than 300,000 members and supporters nationwide.

PRESERVATION GREEN LAB

(www.PreservationNation.org/greenlab)

PGL is a sustainability think tank and national leader in efforts to advance the reuse and retrofit of older and historic buildings. PGL collaborates with partners to develop innovative research, advance public policy, and increase private investment to reduce demolitions and improve building performance. By providing proven solutions to policy makers and building professionals, PGL curbs carbon emissions and enhances the unique character of vibrant neighborhoods. PGL is based in Seattle, Wash. and is a project of NTHP.

NEW BUILDINGS INSTITUTE

(www.newbuildings.org)

NBI is a nonprofit organization that works collaboratively with commercial building market players — governments, utilities, energy efficiency advocates, and building professionals — to remove barriers to energy efficiency.

NATIONAL RENEWABLE ENERGY LABORATORY

(www.nrel.gov)

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

U.S. DEPARTMENT OF ENERGY, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

(www.eere.energy.gov)

The U.S. DOE's Office of Energy Efficiency and Renewable Energy invests in clean energy technologies that strengthen the economy, protect the environment, and reduce dependence on foreign oil.

EXECUTIVE SUMMARY

Small commercial buildings – those smaller than 50,000 square feet – offer substantial and immediate energy efficiency opportunities and cost savings. The Small Buildings and Small Portfolios (SBSP) sector contains 95 percent of all commercial buildings by number and represents 47 percent of the energy consumption in all non-mall commercial buildings. However this building stock has received little attention in the growing energy efficiency marketplace compared to larger and institutionally owned counterparts, in part because of the market's vast scale, physical diversity, and the disparate interests of its stakeholders.

While acknowledging these challenges, this study estimates that profitable investments in energy conservation can generate \$30 billion in annual energy cost savings, improving the financial performance of millions of small businesses throughout the United States.

In support of the development of a national roadmap for energy efficiency in the SBSP sector by the U.S Department of Energy, this report summarizes three years of research by Preservation Green Lab (PGL) about the characteristics of small commercial buildings, analyzes the defining elements of the SBSP sector, and recommends key actions that are necessary to realize the technical potential for energy savings that exists in small buildings and businesses.

KEY RESEARCH FINDINGS

THE SMALL COMMERCIAL BUILDINGS MARKET IN THE U.S. IS VAST, AND MAXIMIZING ENERGY PRODUCTIVITY IN THESE BUILDINGS COULD REDUCE TOTAL ENERGY CONSUMPTION IN THE OVERALL COMMERCIAL SECTOR BY AS MUCH AS 17 PERCENT USING CURRENT, COST EFFECTIVE TECHNOLOGY.

The SBSP sector represents 4.4 million small buildings, with an average size of approximately 8,000 square feet. These buildings contain 7.0 million business establishments, 84 percent (5.9 million buildings) of which are owned by small businesses, or firms with fewer than 500 employees. Conversely, approximately 16,000 larger firms hold portfolios totaling 700,000 buildings – an average of 46 buildings per firm.

Cost effective energy savings of more than 45% are possible in small commercial buildings. Compiling research conducted by the National Renewable Energy Laboratory, the Pacific Northwest National Laboratory, the Energy Star program, and the American Society of Heating, Refrigeration, and Air Conditioning Engineers, PGL estimates that the current potential for economically viable savings in buildings typical of the SBSP market ranges from 27 percent to 59 percent of current energy use, depending on building type, and can yield annual energy savings of 1.07 Quadrillion Btu or 17 percent of energy consumption in the commercial sector as a whole.

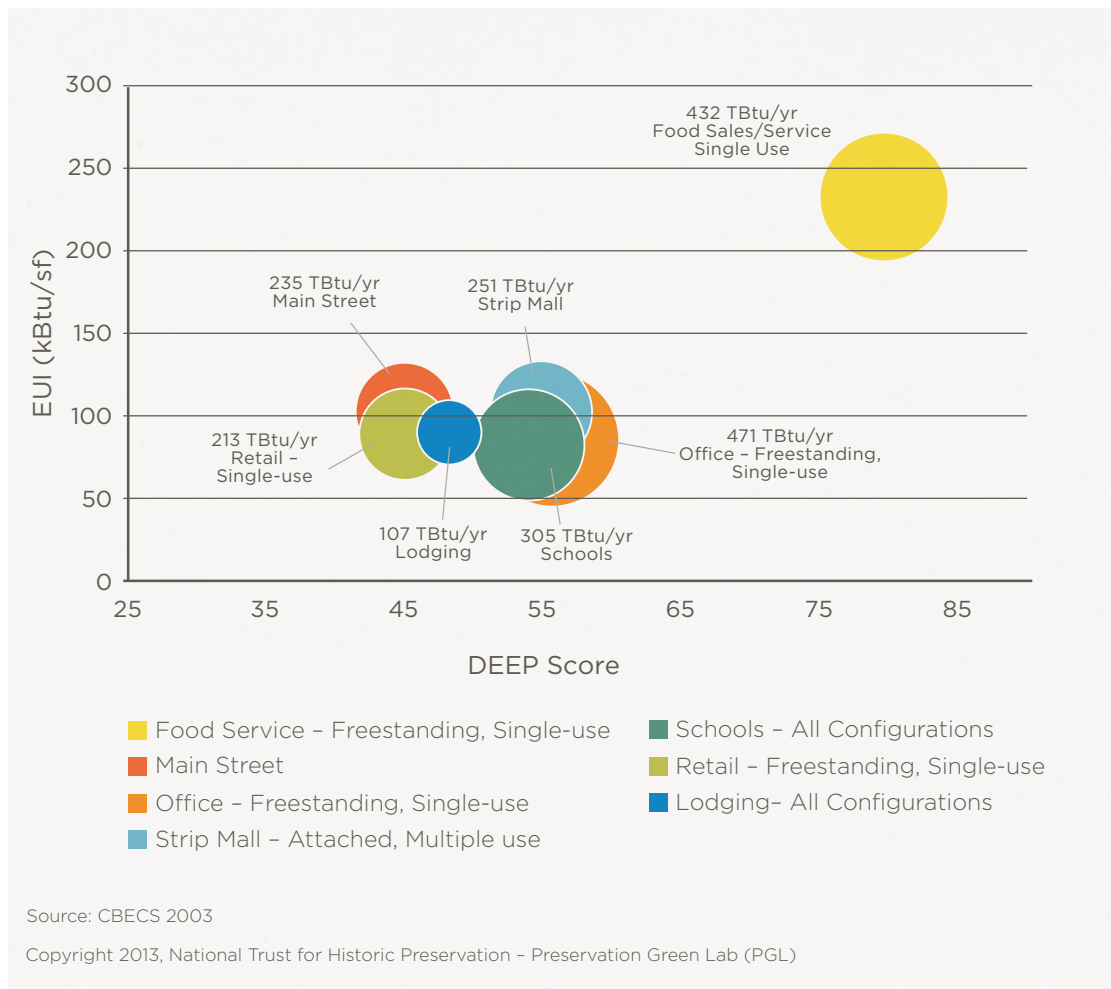
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A high proportion of energy use in small commercial buildings is concentrated in a few building types, making a fragmented market easier to access with targeted programs.

Seven primary building types represent the majority of sector energy consumption at 2.0 Quadrillion Btu of energy annually: food service, Main Street (defined as attached, multiple-use) buildings, strip mall, lodging, retail, office, and schools. These types represent more than 2 million buildings, 19 billion square feet, and 3.6 million businesses.

Buildings typical of Main Street style commercial districts are especially noteworthy because they are energy intensive and offer significant potential for deep energy savings due to their unique physical features. The close relationships between owners and occupants also help to alleviate a significant barrier to entry in this market.

Deep Energy Efficiency Potential (DEEP) Rating for Target Building Types with Average Energy Use Intensity and Total National Energy Use

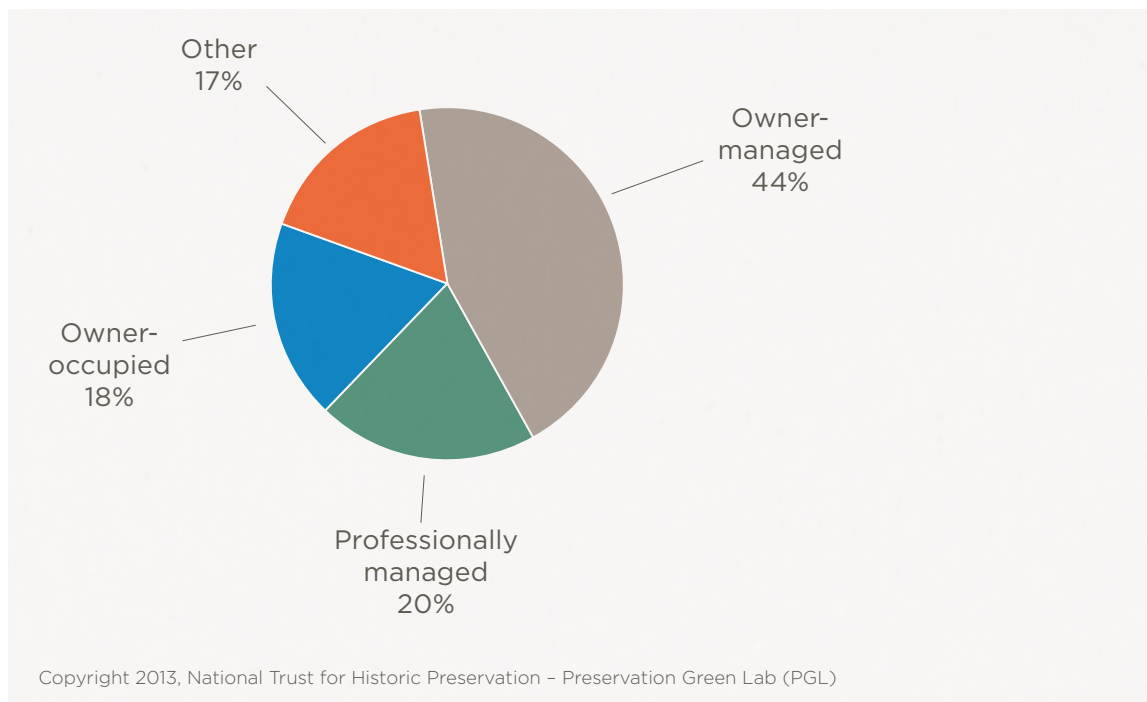


The DEEP score is an index that assembles four components onto a single scale of 0 to 100. The index ranks building types by their potential for achieving broad market acceptance for deep energy efficiency retrofit: energy density, EUI ratio, market factor, and scale factor. Descriptions of DEEP components can be found in Appendix B.

There are great similarities between the residential sector and the small commercial sector, especially the need for simple and scalable solutions.

Both sectors have millions of buildings and decision makers who are motivated by convenience and emotional drivers. In the case of small commercial buildings, owners and tenants are often motivated by improving business identity and by relationships with peers in the direct vicinity.

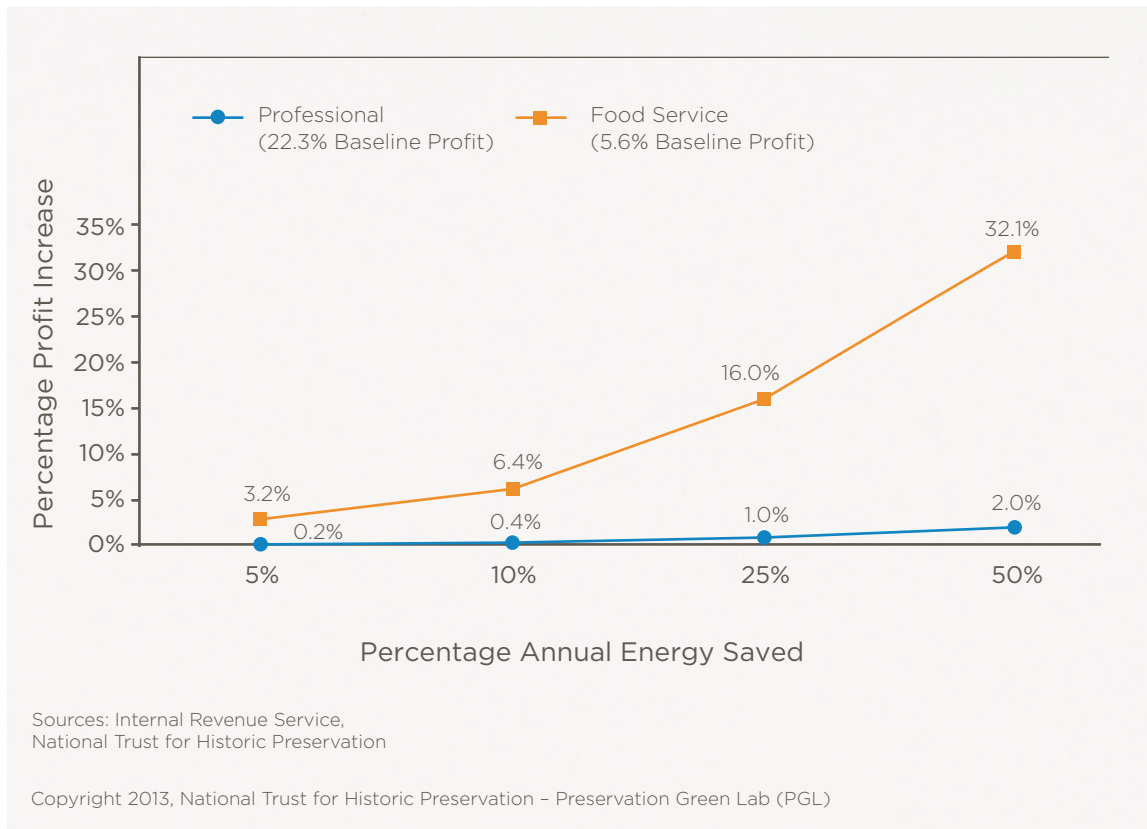
Owners are involved with operational decision making in two-thirds of small commercial buildings. The success of utility-based “direct install” conservation programs in serving residential and small commercial customers suggests that both sectors benefit from reliable information and turnkey solutions that minimize the time and capital required to undertake energy-saving projects.



Buildings that serve businesses with lower profit margins and high energy costs, such as grocery stores and restaurants, often stand to gain the most from energy conservation.

Small businesses in this market segment have many competing priorities for time and capital, and they tend to adopt energy conservation practices when turnkey solutions to installation and financing are provided.

Increased Business Profit from Utility Savings



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

Most businesses want and need a single point of contact to manage energy projects for them, and existing staff within business districts therefore offer a key to unlocking potential savings in small commercial buildings. District- or neighborhood-scale solutions which take advantage of similar physical building characteristics, business identity motivations, and relationships with peers offer a clear way to address the diverse and fragmented SBSP market, enabling economically scalable applications of retrofit strategies across large numbers of buildings.

RECOMMENDATIONS

The research and analysis presented in this report show a tremendous opportunity to reduce energy consumption in small commercial buildings nationwide. However, the technical and economic potential of the market must be met with new sources of capital to fund the most promising approaches and technology. Subtle shifts in the business alignment between the sectors stakeholders could have a profound impact on the flow of private capital available to long term energy conservation efforts.

IDENTIFY WASTE AND MEASURE RESULTS.

To realize the full energy saving potential of small buildings, energy policy makers must support solutions that measure, motivate, and monetize real energy performance. While seemingly counter-intuitive, large investments that fundamentally reduce energy demand put long term downward pressure on utility rates. However, many utilities currently make less money if they sell less energy, and so they have few incentives to save besides regulated mandates. Regulators such as utility commissions can play a pivotal role in allowing utilities to make more money saving energy than they now do generating or distributing it. Critical to achieving this shift without forcing additional costs onto ratepayers is allowing utilities to invest in energy saving projects on the customer's side of the meter. Pilot projects are needed that establish and pay fair market value for energy savings that are measured within these conservation projects. At scale, multi-year utility contracts for persistent and verifiable savings can replace the construction of costly power plants and transmission infrastructure.

PLAN FOR IMPROVEMENT.

To optimize energy efficiency in small buildings, investors must align the timing of energy saving improvements with natural opportunities in the life cycle of a building, such as during acquisition, operational initiatives, tenant improvements, renovations, and equipment replacement. In contrast, most utility funded conservation incentives occur one time and are intended to support installation of a single piece of equipment. More relationship oriented approaches between utilities, third party service providers, and energy customers tend to deliver utility investments and incentives alongside much more substantial sources of capital and construction expertise, creating opportunities for more comprehensive energy retrofits.

ENCOURAGE INNOVATIVE NEW BUSINESS MODELS.

The millions of diverse businesses in small buildings represent a large, untapped market for energy efficiency services. As heating, cooling, and lighting system controls become increasingly digital, new hardware and applications are automating how energy customers can save energy. National data standards, such as the Green Button initiative, are enabling the creation of large networks that can mine building energy data and help save customers money. These technological advancements enable new ways to sell energy services. *Utilities*

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and local energy regulators must collaborate with industry champions in pilot projects, demonstrating how new technologies can more easily and cost effectively reach small businesses in different types of buildings.

KEY ACTIONS FOR STAKEHOLDERS

This report recommends discrete actions for the sector's stakeholders to maximize the energy performance of small buildings and enhance the financial performance of the businesses that rely on them.

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 demonstration projects:															
a. Support the implementation of federal, state, and local pilot projects that utilize utility Power Purchase Agreements (PPA) to pay 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.	★	★		★		★	★	★	★	★	★	★			

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STAKEHOLDER															
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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.