Improving the Energy Performance of New and Existing Commercial Buildings: A DOE Status Report

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ABSTRACT

It is technically and economically feasible for our nation's commercial buildings to consume substantially less energy—and produce substantially less carbon dioxide—than they do. Yet owners of existing buildings are not taking full advantage of today's best energy-saving technologies and practices; and developers of new buildings are, most often, constructing to minimum energy codes rather than pushing for greater efficiency. Through its Commercial Building Initiative, the U.S. Department of Energy (DOE) is addressing these challenges by developing cost-effective technologies and practices that deliver significant improvements in commercial building performance. DOE is also collaborating with industry-leading companies and organizations to demonstrate, monitor, and help move these technologies from the laboratory to the marketplace. Ultimately, DOE's dual strategy of pairing aggressive research and development with market engagement, demonstration, and deployment will dramatically improve the energy performance of new and existing commercial buildings throughout the nation.

Background

DOE enables the adoption, at speed and scale, of significant energy performance improvements in existing and new commercial buildings throughout the United States by providing a suite of cost-effective tools, integrated technology solutions, and best practices. The goal is to influence the energy performance of 3 billion square feet (total) of existing and new commercial floor space every year, with increasingly aggressive targets for cost-effective energy savings into the future. The deployment orientation of the initiative emphasizes aggressive near-term targets, in addition to the longer-term net-zero energy mandates of the Energy Independence and Security Act (EISA) of 2007 and the greenhouse gas emissions reduction targets in the Copenhagen Accord for the year 2020 (DOE EERE News). These targets will be regularly assessed and revamped as informed by roadmapping exercises with key stakeholders in the commercial building sector.

The initiative's balanced portfolio between existing and new buildings is demonstrating the growing technical feasibility of increasing energy performance for both building types. In retrofits, cost-effective savings of more than 30 percent are attainable within the business models of most companies. In new construction, energy-saving practices and technologies have advanced to such an exemplary level that renewable energy sources could supply the balance of energy needs in many commercial buildings—resulting in net-zero energy buildings (NZEBs).

Significantly raising the efficiency level of existing and new commercial buildings will be among the most effective and economically sound strategies available to the United States for reducing carbon dioxide emissions in coming decades. Many of the negative-cost options for

abatement of carbon dioxide highlighted by McKinsey & Company are commercial buildings measures (McKinsey & Company 2007). Further, a recent report by the United States and partners of the Major Economies Forum stated, "Energy efficiency in buildings often tops the list of carbon mitigation options, largely because of the opportunities that can be achieved at low or negative net cost—saving both energy and money. Moreover, many of the technologies and practices to achieve these reductions are available today" (United States in consultation with Major Economies Forum partners 2009).

The nation's approximately 5.3 million commercial buildings consume 18.5 quadrillion British thermal units (quads) per year of primary energy, accounting for 19 percent of U.S. primary energy consumption. Because energy use and carbon emissions are highly correlated, the energy-intensive stock of commercial buildings is also responsible for 19 percent of the nation's energy-related carbon dioxide emissions, or 1084 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) (DOE/EIA 2009). The Energy Information Administration projects that the sector will grow by a net of 1.5 million buildings by 2030, driven by both population growth and economic growth. This growth will require another 4.4 quads of energy—nearly all of it electricity load growth—and add another 200 $MMTCO_2e$ to the atmosphere (DOE/EIA 2009).

The Commercial Building Initiative uses two key strategies to influence the energy efficiency of commercial buildings: engaging the market and influencing the stringency of regulations.

- Market engagement primes the commercial sector with a balanced suite of tools, technologies, and best practices that are needed to achieve significant energy-efficiency improvements. Methods of engagement include direct DOE interaction with commercial building owners and operators through the Commercial Building Energy Alliances (CBEAs) and Commercial Building Partnerships (CBPs), which are the focus of this paper. Other methods include interagency efforts (working with the Federal Energy Management Program and the U.S. General Services Administration to pilot efficiency at scale in federal buildings), leveraging existing local and regional efforts (e.g., utilities, regional energy-efficiency programs, centers of excellence, etc.), and broad outreach to the stakeholder community (e.g., the Commercial Building Consortium, High Performance Green Building Clearinghouse, etc.).
- With regard to regulation, DOE will help to expand the availability of cost-effective technology options, thus expediting and expanding the range of options considered in upcoming building codes and equipment standards. There is precedent for this, as the existence of the 30% Savings Advanced Energy Design Guide series has informed the stringency of ASHRAE Standard 90.1-2010.

DOE has set ambitious goals for improved energy performance in existing and new buildings as seen in Tables 1 and 2. These performance goals are derived from the greenhouse gas (GHG) emissions reduction goals of the Copenhagen Accord (17 percent reduction below 2005), the president's long-term GHG reduction goals (83 percent by 2050 below 2005), as well as the requirements set forth in the Energy Independence and Security Act of 2007 (EISA 2007), which calls for the nation to realize economically viable net-zero energy buildings in new construction by 2030, in half the stock by 2040, and for all buildings by 2050.

Table 1: Energy Performance Goals for Existing Commercial Buildings

	2015	2020	2025	2030
DOE Enabling RD&D Goal for Existing	50% relative to actual use, with 3- to 4-year simple payback	55% relative to actual use, with 4- to 5-year simple payback	60% relative to actual use, with 5-year simple payback	65% relative to actual use, with 5-year simple payback

Source: DOE 2010

Table 2: Energy Performance Goals for New Commercial Buildings

	2015	2020	2025	2030
DOE Enabling RD&D Goal for New	65% with 5-year payback relative to ASHRAE Standard 90.1-2004	70% (zero-energy buildings with renewable energy technologies) with 5-year payback relative to ASHRAE Standard 90.1-2004	70% (zero-energy buildings with renewable energy technologies) with 5-year payback relative to ASHRAE Standard 90.1-2004	

Source: DOE 2010

Driving substantial improvements in *cost-effective* building energy performance is a formidable research, development, and demonstration (RD&D) challenge that requires integration of complex systems engineering, advances in component technology, and rigorous capabilities in modeling, field measurement, and field verification. It also will require very significant deployment, in real buildings, to achieve carbon mitigation at scales large enough to matter. Deployment will come in the form of collaborative efforts with commercial building owners and professionals whose investments in high-performance design and construction are prerequisites for moving building technologies from the laboratory to the marketplace.

DOE has established strategic partnerships with building industry professionals through the CBEAs and the CBPs. These collaborations provide the real building "test beds," insight into market barriers, and potential for replication of successful approaches throughout large portfolios to raise the level of performance in existing and new buildings. This paper explores these collaborations and their potential to put the nation on a more direct and swift course to substantial energy reductions in the buildings sector.

Engaging the Market

Ultimately, significant energy savings will not be realized unless building owners install innovative technologies and adopt best practices in individual buildings, validate the energy performance and cost effectiveness, and then replicate successes throughout their portfolios. Fortunately, there is an influential community of industry leaders who are committed to pushing the boundaries of building performance and sharing the results. These leaders are working closely with DOE and the national laboratories through the auspices of the CBEAs and CBPs, providing the market link needed to properly deploy technologies and transform the buildings sector.

Commercial Building Energy Alliances

DOE facilitates three industry-led alliances, each with membership representing substantial proportions of the total floor area in their respective sectors: the Retailer Energy Alliance (18%), the Commercial Real Estate Energy Alliance (23%), and the Hospital Energy Alliance (17%). The alliances are informal associations of commercial building owners and operators who want to reduce the energy consumption, greenhouse gas emissions, and operating expenses of their buildings. Alliance memberships as of May 2010 are shown in Table 3 (DOE 2010). A steering committee of members operates each alliance, with facilitation and technical support provided by DOE and by DOE's supporting national labs: Lawrence Berkeley National Laboratory, the National Renewable Energy Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory.

For efficiency and focus, each CBEA forms subcommittees around particular technology areas or industry subsectors of interest, and these subcommittees work with DOE and the national labs on projects that include benchmarking, best practices, and development of performance specifications for specific systems and technologies. (This process is described in more detail later.)

The CBEAs also host supplier summits, during which members tell suppliers how they can help meet their goals. The annual HVAC, Lighting, and Renewable Energy summits have attracted more than 300 suppliers. Discussions center around the barriers to purchasing energy-efficiency equipment (e.g., short warranties, inconclusive evidence on product performance and life cycle, and upfront cost differentials) and the market need for energy-efficient technologies.

During a breakout session on retrofit technologies at the 2009 Lighting and Controls Supplier Summit, representatives from Walmart, The Home Depot, and Macy's told suppliers they were looking for light-emitting diodes (LEDs) in both cool and warm color temperatures, depending on the application, with color rendering higher than 90. They also told manufacturers that they will not consider anything with a return on investment of more than two years for energy-efficient lighting products that fit into their existing systems. These types of specific requests from retailers, hospitals, or commercial real estate companies with significant buying power are the reasons suppliers attend the summits. Another draw for suppliers is the "speed-dating" rounds, during which suppliers meet for five minutes one-on-one with representatives from member companies such as Hospital Corporation of America, Target, and The Westfield Group. This activity gives suppliers opportunities to provide specific product information to company representatives and answer questions or concerns companies may have about investing in their products.

CBEA members are positioned to drive significant changes in the commercial buildings industry. One way they do this is by sharing non-proprietary information with fellow CBEA members and others in their building sectors related to developing and promoting best practices for the industry and reinforcing the business case for energy efficiency. Members often present at building, manufacturing, and energy conferences to discuss their energy targets and practices in relation to DOE's goals and activities. In January 2010, Retailer Energy Alliance members Walmart and Target presented together at the Air-Conditioning, Heating, and Refrigerating (AHR) Expo. During the session "The Great Debate: Walmart and Target on Energy Efficiency," the presenters compared company footprints and aggressive goals for energy efficiency. The presentation was very popular with manufacturers attending the expo and provided great exposure for the CBEAs and their goals.

Table 3: Members of DOE's Commercial Building Energy Alliances

Retailer Energy Alliance	Commercial Real Estate Energy Alliance	Hospital Energy Alliance
A&P	AtSite	Adventist HealthCare
Applebee's International, Inc.	Bank of America	Ascension Health
Army & Air Force Exchange Service	Big Rock Partners, LLC	Boulder Community Hospital
Bank of America	Calvert Group, Ltd.	Catholic Health Initiatives (CHI)
Belk, Inc.	Cassidy Turley	Catholic Healthcare West
Best Buy Co., Inc.	CB Richard Ellis Group, Inc.	Clarion Hospital
BJ's Wholesale Club, Inc.	Core Properties, Inc.	Cleveland Clinic
Boston Market Corp.	Corporate Office Properties Trust	Dartmouth-Hitchcock Medical Center
Chipotle Mexican Grill, Inc.	Cushman & Wakefield Inc.	Department of Veterans Affairs
CKE Restaurants, Inc.	Dacra Development	Geisinger Health System
Costco Wholesale Corp.	Edens & Avant	Gundersen Lutheran Health System
Crate and Barrel	Forest City Enterprises, Inc.	Hackensack University Medical Center
Food Lion, LLC	Glenborough, LLC	Health Care REIT
Ford Motor Co.	Grubb & Ellis Co.	HealthSouth
Harris Teeter Inc.	H&R Block Inc.	Hospital Corporation of America
JCPenney	HAL Real Estate Investments, Inc.	Inova Health System
John Deere	Hilton Worldwide	Johns Hopkins Health System
Kohl's Department Stores	Hines	Kaiser Permanente
Lamey-Wellehan Shoes	Hyatt Hotels Corp.	Legacy Health System
Lowe's Companies, Inc.	IBM	Metro Health Hospital
Macy's, Inc.	InterContinental Hotels Group	NewYork-Presbyterian Hospital
McDonald's Corp.	Jones Lang LaSalle	Partners HealthCare
OfficeMax Inc.	Liberty Property Trust	Providence Health & Services
Panda Restaurant Group, Inc.	Marriott International, Inc.	Rush University Medical Center
PETCO Animal Supplies, Inc.	MGM MIRAGE	San Luis Valley Regional Medical Center
ProLogis	Opus Corp.	Texas Children's Hospital
Publix Super Markets	Prudential Financial, Inc.	Texas Medical Center (TECO)
Recreational Equipment, Inc.	Regency Centers Corp.	TRICARE Management Activity (TMA)
Rutter's Holdings, Inc.	Ryan Companies US, Inc.	University of Pittsburgh Medical Center
Safeway Inc.	Schaad Companies	Veterans Health Administration
Sears Holdings Corp.	Simon Property Group, Inc.	Yale-New Haven Hospital
Sonic Corp.	Stream Realty Partners, L.P.	
Staples, Inc.	The PNC Financial Services Group, Inc.	
SUPERVALU INC.	The Related Companies, L.P.	
Target Corp.	The Walt Disney Co.	
The Home Depot, Inc.	The Westfield Group	
The Stop & Shop Supermarket Co.	Tishman Speyer Properties	
Toyota Motor Sales, U.S.A., Inc.	Transwestern Property Co.	
Walgreen Co.	U.S. General Services Administration	
Walmart Stores, Inc.	USAA Real Estate Co.	
Wawa, Inc.	Vornado Realty Trust	
Wendy's/Arby's Group, Inc.	Wright Runstad & Co.	

Retailer Energy Alliance	Commercial Real Estate Energy Alliance	Hospital Energy Alliance
Whole Foods Market, Inc.	Wyndham Hotels and Resorts, LLC	
Yum! Brands		
Supporting Associations: American Hotel & Lodging Association, ASHE, ASHRAE, BOMA International, IES, IFMA, International Council of Shopping Centers, NAIOP, National Association of Convenience Stores, National Multi Housing Council, Practice Greenhealth, Retail Industry Leaders Association, Sustainability Roundtable Inc., The Real Estate Roundtable, Unified Foodservice Purchasing Co-op, LLC, VHA		

Source: (Commercial Building Energy Alliances 2010)

Commercial Building Partnerships

Commercial Building Partnerships are companies working with DOE and the national labs on specific retrofit and new construction building projects to transform their building delivery and management processes, with the goal of achieving whole-building energy savings of 30 percent in retrofits and 50 percent in new construction. Partner companies typically hold large building portfolios and design, build, own, manage, or operate their own buildings, creating significant potential to replicate lessons learned from specific projects throughout their portfolios. Companies with more modest building portfolios also can participate, provided they include a replication component within their projects. Best Buy, Westfield Properties, Macy's, and PNC Bank are just some of the 22 companies—with about 2.4 billion square feet in their portfolios—currently working with national labs on CBP projects. The projects can then serve as prototype buildings for exemplary performance in their respective sectors. The resulting projects, and the insight, detailed measurement, lessons learned, and verification that accompany them, will also inform development of DOE's R&D portfolio going forward and provide the operational and cost data needed to make a solid business case for investment in high-performance buildings.

Table 4: Whole-Building Energy Savings Goals for Commercial Building Partnerships

	2010	2015	2020
Existing Building Projects	30%	50%	55%
New Building Projects	50%	65%	70%

Source: DOE 2010

In the first round of projects, companies partnering with national labs were competitively selected through a DOE laboratory solicitation. Each CBP project is nominally five years with the first year representing benchmarking, project identification, and goal setting; the second year analysis and design implementation; the third, construction; the fourth, data collection and analysis; and the fifth year, reporting. The effort is now in its second year.

The CBPs operate as a public/private cost-sharing program. Each partner commits to cost-share 20 percent of the total value of the project in the form of company resources. They will track their participatory expenses and report this information to the national labs.

DOE has provided Recovery Act funding for the national labs to expand the number of CBPs in 2010 and to potentially pursue innovative projects that exceed the 30 percent in existing and 50 percent in new construction energy targets mentioned above. In addition, DOE will consider funding projects that accelerate portfolio-wide implementation of technologies. In all cases, projects must have replication potential.

Zero Energy Commercial Buildings Consortium

Additional support and assistance from organizations and building professionals is provided by the Zero Energy Commercial Buildings Consortium (ZECBC). Initiation of the consortium was called for in Section 421 of EISA 2007 and DOE recognized the consortium in October 2009. ZECBC, convened by the National Association of State Energy Officials (NASEO), is a public/private consortium with broad industry representation that works with DOE to develop and deliver technology, policies, and practices to achieve the commercial building energy goals. The more than 300 member organizations of ZECBC include representatives from building code agencies and organizations, utility energy-efficiency programs, and the development, construction, financial, and real estate industries, among others. DOE consults with the consortium, utilizing the technical expertise of its members to move the market toward increasing levels of building performance in the three current CBEA target markets: commercial real estate, retail, and hospital. In addition, the consortium helps DOE by collecting information on current and next-generation technologies for building components and systems, communicating the emergence of new technologies to the commercial building community, and promoting the demonstration of high-performance building technologies.

Market Integration and Deployment

Research and development of new technologies and systems for commercial buildings alone will not dramatically change the energy performance of buildings today or tomorrow. The market must adopt and deploy the technologies in order to see substantive changes in energy use.

DOE's systematic market engagement, integration, and deployment strategy is designed to leverage DOE's resources with partners in the commercial sector to accelerate integration of new practices and technologies in their portfolio of existing buildings and in their designs of new buildings.

Commercial Integration in Practice

One way to pull the market toward above-code exemplary energy performance is to provide architects, engineers, and other design practitioners with guidance that indicates, measure by measure, how to do it. To this end, DOE supports development of a series of Advanced Energy Design Guides (AEDGs)—publications designed to provide recommendations for achieving 30 percent to 50 percent energy savings over the minimum code requirements of Standard 90.1-1999. (AEDGs also provide savings against subsequent versions of Standard 90.1.) With DOE technical and financial support, AEDGs for 30 percent savings have been published by ASHRAE for six building types: small offices, small retail buildings, warehouses, K–12 schools, highway lodging, and small healthcare facilities. These guides are available for free download from ASHRAE's Web site (ASHRAE et al. 2010); documentation of the approach and assumptions of the analysis is also provided by concomitant national laboratory document reports (NREL & PNNL 2010).

DOE supported a market evaluation of four of the 30 percent savings AEDGs to determine their level of use and discernible market impact. The evaluation, by the Energy Center of Wisconsin, found that: "Some design professionals use the AEDGs as a comprehensive guide for achieving whole building energy performance and others use the guides selectively to inform

specific components of the building design. The AEDGs are also being used to support energy-efficiency retrofit projects and on building types that are outside the targeted small commercial markets" (Energy Center of Wisconsin 2009). Based on this positive evaluation, DOE is developing AEDGs to achieve 50 percent whole-building savings in the following building types: small and medium offices; grocery stores; and medium box retail stores.

There is also emerging evidence that the availability of the AEDGs, by showing that exemplary performance is achievable, has informed discussions about the potential energy stringency of the commercial building standard, including the development of the ASHRAE 90.1-2010 Standard. Development of a series of 50 percent savings AEDGs may, in turn, inform the stringency of future standards.

Technology and System Specification/Technology Procurement

Technology specification and procurement efforts are designed to bring innovative energy-saving technologies and systems at the most competitive price to the market for use in both retrofits and new construction. The intent is to communicate CBEA member performance expectations to suppliers so members can purchase equipment that is more efficient and better suited to their facilities than currently available technologies. These projects are collaborative efforts between CBEA members and the national labs. CBEA members choose the technologies to specify—focusing on those for which there is the most compelling market need—and the national labs help identify key performance parameters based on member needs and guide iterative discussions with equipment manufacturers to come to the desired "stretch" performance specification.

The specifications typically set minimum performance requirements, including any test results or data to support those claims, warranty requirements, and other product or system characteristics that specification developers deem important. Collective CBEA support of these product or performance specifications demonstrates demand to manufacturers and is expected to lead to greater product availability and quality and more competitive pricing. Projects under way include:

- LED Site (Parking Lot) Lighting
- LED Refrigerated Case Lighting
- High Efficiency Parking Structure Lighting

CBEA members are in the process of identifying additional specification projects of interest, including one on rooftop air-conditioning units.

LED site (parking lot) lighting technology specification project. Retailer Energy Alliance (REA) members chose LED site lighting as the first specification project in March 2008 because of its broad applicability and because energy-efficient LED technology was fast becoming a viable option in outdoor area lighting applications. In addition, REA Steering Committee member Walmart announced its intention to equip 1,000 parking lots with LED lighting.

Members of the LED Site (Parking Lot) Lighting Working Group, which now includes members from all three alliances, believed their collective buying power could influence the performance of new LED site lighting products, help build volume, and lead to lower prices. The specification they developed, in cooperation with DOE and Pacific Northwest National

Laboratory (PNNL), provides information about both the luminaire and how the site should be lighted (PNNL 2009). The specification was released in November 2008 and updated in June 2009. Key details of the specification are:

- Both power density and illuminance requirements are by lighting zone (LZ); different environments need more or less light (and thus use power differently).
- Different amounts of light (illuminance) are needed for different parts of the parking lot.
- Lighting uniformity is treated differently than the standard maximum-to-minimum ratio and is instead represented by a weighted average of relevant illuminance measurements.
- Luminaires should be compliant with "BUG" requirements in IESNA TM-15.
- Luminaires should carry a five-year warranty covering the luminaire, finish, and power supply.
- Testing requirements are identified.

The CBEA working group also collaborated with DOE's Solid-State Lighting (SSL) Program to complete GATEWAY Demonstration projects at a number of sites, including at a Walmart Superstore in Leavenworth, Kansas. GATEWAY Demonstrations showcase high-performance LED products for general illumination in a variety of commercial and residential applications and provide field-validated experience and data on state-of-the-art SSL product performance and cost effectiveness.

Additional activities may include a technology procurement effort using the CBEA-developed performance specification, on behalf of smaller CBEA buyers and new alliances, such as the alliance for higher education. DOE has used the technology procurement approach successfully in the past for compact fluorescent lighting (Sandahl 2006, 2008).

High efficiency parking structure lighting. Parking structures typically operate for long hours—sometimes around the clock—but are rarely at full occupancy. While traditional high-intensity discharge (HID) sources for parking structure lighting do not work well with occupancy sensors or dimmers, high-efficiency alternatives such as fluorescent, induction, or LED sources are more amenable to the use of controls. Such controls could significantly reduce energy consumption by monitoring space occupancy and the amount of daylight available to each space. As an additional benefit, the high-efficiency alternative sources have rated lives equal to or longer than HID sources.

In order to maximize benefits of converting traditional HID technology to high-efficiency alternative technologies, CBEA members, in coordination with DOE, PNNL, the National Renewable Energy Laboratory (NREL), and Lawrence Berkeley National Laboratory (LBNL), are developing performance specifications for high-efficiency parking structure lighting that should be applied to a specific site. The final version is expected in 2010.

LED refrigerated case lighting. According to a recent study, 2.1 TWh of electricity could be saved annually nationwide if 100 percent of retail refrigerated display cases were switched to LED systems—enough to power more than 160,000 households (Navigant Consulting 2008). A CBEA working group—with technical assistance from DOE and PNNL—is finalizing a set of technology specifications for LED lighting in refrigerated display cases, based on their six-month investigation of field and laboratory performance of candidate luminaires. While LED luminaires are still relatively expensive on a first-cost basis when compared with fluorescent

lamps, the group found the technology can be a sound investment on a life-cycle basis due to energy savings, long life, and reduced maintenance costs. Utility and energy-efficiency groups that offer rebates on certain LED refrigerated case lighting products were also involved in the effort to help ensure consistency in the resulting specifications and rebate requirements. The final specification is expected in May 2010.

Technology Identification and Screening

Validating the promises of energy-efficiency technologies is one of the biggest challenges commercial building owners face when trying to reduce the energy consumption of their buildings. DOE supports CBEA members in this regard by helping to identify, screen, and validate the claims of new and underutilized energy-efficient technologies through technology identification and screening. This process aims to accelerate the application of "proven" technologies in existing and new commercial buildings and to help identify technologies suitable for the technology specification process described previously. Technology nominations are sought from a wide range of potential contributors, including CBEA members, technology developers and vendors, the national labs, and the DOE Inventions & Innovations Program. Nominated technologies are screened against criteria (developed in consultation with CBEA members) and information about technologies that satisfied the criteria is presented to the CBEAs for project consideration, including inclusion in technology specifications, demonstrations, and best practices guides.

To date, more than 160 technologies have been nominated, covering a range of building materials and systems, including building envelope, refrigeration, lighting, controls, energy management, and heating, ventilation, and air conditioning (HVAC).

Commercial Technology Solutions Tools

DOE is developing a series of flexible Commercial Technology Solutions to identify the low-energy technical pathways of attaining specific energy and economic goals for specific projects. The output is a series of Web-based decision tools targeting commercial building design teams. When complete, Commercial Technology Solutions can be used to evaluate system-level packages of technologies, such as lighting, daylighting, supermarket refrigeration, and packaged HVAC. These Web-based tools will provide commercial building designers, operators, and utility program managers with accessible, actionable, and measurable packages of solutions for improving both their existing building systems' efficiency and that of new buildings.

The Commercial Lighting Solutions (CLS) Web tool, the first developed, targets a 30 percent reduction in lighting energy consumption below Standard 90.1-2004. Achieving deep energy savings in lighting is a complex design challenge. These solutions—developed in partnership with top lighting designers, architects, and commercial end-users—are delivered through an interactive Web tool that estimates energy savings based on project-specific inputs.

Solutions are now available for five types of retail stores (big box, small box, grocery, specialty market, and pharmacy), and a beta version for offices was completed and peer reviewed in late 2009. Future versions will include solutions for other sectors, including hospitals and schools. Each solution includes a series of "design vignettes," complete with lighting layouts and

component specifications, as well as daylighting design where appropriate. The vignettes are accompanied by recommended control schemes and commissioning guidance. Version 2.0 of the Webtool was released May 2010 at LIGHTFAIR® International.

Conclusion

Working in tandem with industry-leading companies and organizations is a sound strategy for significantly improving the energy performance of the nation's commercial buildings and slowing GHG emissions. DOE, through its Commercial Building Energy Alliances and Commercial Building Partnerships, continues to raise the bar on building performance, providing a suite of cost-effective tools, integrated technology solutions, and best practices, together with real-world case studies that demonstrate the compelling business case for energy efficiency. By joining the capabilities of the national labs with those of leading companies, DOE will be well positioned to meet the goal of the Commercial Building Integration and Deployment's Commercial Building Initiative: influencing the energy performance of 3 billion square feet (total) of existing and new commercial floor space each year, with increasingly aggressive targets for cost-effective energy savings into the future.

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