

Scalable Commercial Lighting Solutions for the Mainstream Market

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ABSTRACT

Inevitably the greatest obstacles to deep energy savings and mainstream market transformation include complexity and cost. Currently there is a tremendous marketplace gap between the need for widespread integrated lighting solutions and the capacity of the market to provide them. This paper will describe how a new USDOE commercial lighting program provides a multi-faceted strategy to provide the needed “how to” guidance in support of the numerous mandates and programs that are reaching far beyond codes and standards. The program provides lighting energy-efficiency solutions using high performance products, daylighting, and lighting controls. These lighting solutions are widely applicable to common spaces and are delivered via an interactive webtool, making them scalable to the mainstream market.

Complexity is reduced by providing pre-designed vignettes and controls strategies that can be reviewed and selected by the end user or design team. The webtool provides analysis and documentation to show performance against energy goals in support of end-user applications for incentives, which addresses the cost obstacle. Utilities and Energy Efficiency Program Sponsors (EEPS) benefit by having actionable guidance for customers and energy analysis sufficient to create programs designed around kWh savings rather than Lighting Power Density (LPD) or component-based rebates.

The program is organized around the major commercial market sectors: retail, commercial real estate (e.g., offices, developers, lodging), and institutional (e.g., healthcare, education). This allows design solutions to be developed specifically for each sector with the input of the appropriate end users. The partnership model for the program is robust (including end users, design professionals, manufacturers, Non-Governmental Organizations (NGO’s), and EEPS) and provides the network by which feedback is gathered, lighting solutions are deployed, and performance is measured.

Introduction

The US DOE Building Technologies Program (BTP) strategic goal begins with the following statement: “To create technologies and design approaches that enable net-zero energy buildings at low incremental cost by 2025.” Further, the Multi-Year Program Plan (MYP) states, “Important breakthroughs include **the development of integrated design approaches to ZEB**, as well as technology breakthroughs such as solid state lighting and electrochromic windows.” (Bold added.) More than ever before, BTP is committed to the efficiency gains that will be realized through deep integration of efficient systems, and of necessity, must also include changes in design practices as a means to achieve integration. A healthy energy efficiency portfolio includes not only technology development, but also deployment activities designed to break down market barriers and increase uptake of advanced technologies, design practices, and systems integration.

Of all the building systems, lighting is the largest single end use in commercial buildings, consuming 25% of total primary energy, roughly equal to the total use of space heating and cooling. (EIA, 2007) This represents a savings opportunity that merits an aggressive and comprehensive approach. Recognizing the importance of lighting, the DOE BTP has created a focused effort to harness this energy savings potential. The Commercial Lighting Solutions program (CLS), described herein, has as its core product guidelines on best practices delivered via a webtool.

The best practices developed by the CLS program are the *Commercial Lighting Solutions*, which are integrated lighting designs created with the intention of widespread adoption through end users, stakeholders, and, ultimately by mainstream designers and builders. They provide detailed and actionable specification information about the use of advanced energy efficient lighting technologies within the context of design vignettes and controls strategies, and with implementation instructions to support usage by end users.

The near term energy savings goal for CLS is 30% below ASHRAE/IESNA Standard 90.1-2004. Importantly, the metric for savings will be kWh rather than Lighting Power Density (LPD). This contributes to the DOE BTP whole building new construction goal of 50% savings by 2015 and 70% by 2025. The goal for existing buildings is a 30% improvement in energy performance by 2025 over the Commercial Buildings Energy Conservation Survey (CBECS) 2003 baseline.

More than ever before, the USDOE energy savings goals are shared by many organizations large and small, and partnership is a fundamental and integral aspect of the CLS program. Partnership within the DOE program is embodied in the new formation of the Commercial Buildings Energy Alliances, which are organized by sub-sector. The alliances are being formed during fiscal years 2008 and 2009 and include the Retailer Energy Alliance, the Commercial Real Estate Energy Alliance, the Institutional Energy Alliance, and an Industry Alliance. The alliances are populated primarily by end users, with the exception of the Industry Alliance, which will include members of the energy efficiency community, NGO's, and building industry representatives. The CLS program supports these alliances with the development of sector-specific best practices for lighting. To-date, *Lighting Solutions* have been developed for box retail stores, and are well underway for offices.

Market Obstacles

The Commercial Lighting Solutions program is designed to overcome many of the critical barriers to advanced lighting technologies, including complexity, cost, and a gap in the level of professional expertise required for standard practice designs versus designs that achieve maximum efficiency and lighting quality simultaneously.

Complexity

Simply put, there is nothing simple about lighting. The variables are seemingly endless, beginning with the fact that every application (e.g., retail vs. office vs. warehouse) has different design criteria requirements, geometries, activities, occupants, aesthetic expectations, etc. Then consider the combination of hundreds and sometimes thousands of available technologies for lamps, ballasts, luminaires, and control systems

Given all the factors involved it is understandable that architects, engineers and other lighting practitioners often use “cookie cutter” solutions that have been developed and deployed repeatedly over many years. Unfortunately, “tried and true” becomes static and stale, and this results in older technologies and designs being installed in new buildings. Highly efficient technologies and innovative design solutions end up being under-utilized partly because it is too complicated to give every new project an entirely custom solution.

Cost

As with all systems that are higher quality and more complex, cost is a significant barrier for efficient and emerging technologies. In addition to the technology costs, design costs for integrated and low-energy solutions are typically more expensive than the run-of-the-mill standard approaches. The cost issues are exacerbated by the fact that many of the end users do not look at the financial issues within the context of a life-cycle cost analysis. First costs remain a significant obstacle to low energy lighting solutions.

Gap in Expertise

According to research done by the New Buildings Institute (NBI, 2006), only 1 new building in 1,000 is built to the Energy Policy Act of 2005 standard. This finding illustrates that dramatic progress is needed in a very short time in order to meet codes and standards, and more importantly, to make a meaningful impact on carbon reduction. The final report from the Getting to Fifty Summit held by NBI (NBI, 2007) and attended by sixty high-level buildings, energy and policy experts in March of 2007, stated:

...the barriers to the widespread design and construction of low-energy buildings are not technical in nature, nor do they appear to be financial; more likely they are related to the motivation of owners and the skill set of the design and construction teams. ... The uncertainties and time requirements of researching and implementing new approaches, and the associated performance risks, continue to be real-world obstacles to improved energy performance.

While a reasonable argument could be had about the relative degree of cost, perceived value, and technical challenge—one can easily agree that we cannot meet our goals without a dramatic change in professional practice. There are many types of lighting professionals who have specification authority and/or significant influence, but their expertise varies widely. This list includes lighting designers, electrical engineers, electrical contractors, lighting manufacturer representatives, lighting retrofitters, electrical distributors, and energy services companies. Unfortunately, budget (rather than need) is the primary factor in determining the level of expertise that a given project will receive. The mainstream market, and most of the professionals listed above, are in need of readily available expert advice if we are to transform standard practice in lighting towards energy efficient quality solutions. The *Lighting Solutions* have been created with this goal in mind.

The Need for “How-To” Guidance

The principle identity and value of the CLS is that it bridges the gap between codes, standards, mandates, policies, and implementation of energy efficiency measures. The lack of actionable “how to” guidance for implementation has been the missing link, especially with respect to aggressively energy efficient designs and integrated lighting systems.

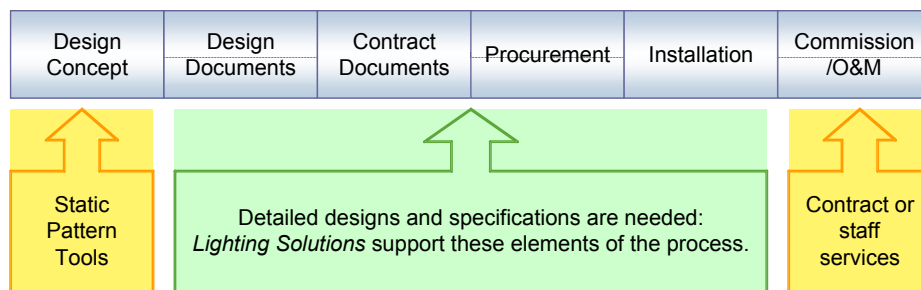
Some of the many organizations and products that require aggressive energy efficiency measures in lighting include: ASHRAE/IESNA Standard 90.1-2004, California Title 24, Architecture 2030, USGBC LEED, Energy Policy Act of 2005, the Clinton Climate Initiative and many others. There are also many state energy offices, utility programs and regional market transformation groups that have efficiency programs. The *Lighting Solutions* offer methods to achieve these goals, and in many cases, provides a way to measure progress against these goals.

Available Guidance

Numerous publications and resources already exist that provide “patterns” that can help with creating efficient lighting designs. Examples include: the Advanced Lighting Guidelines, Design Lights Consortium Know-How Series, and the Unified Facilities Criteria. Each of them has merits and benefits, offering some excellent concepts for efficient lighting. Unfortunately, most of them, by virtue of the fact that they are publications, will become less useful over time.

Additionally, static pattern tools are conceptual by nature. While these concepts usually represent excellent ideas, it still falls to the design team to bridge the gap by seeking out the details required to implement the concepts. In many cases this can prove a daunting obstacle to executing the ideas (see Figure 1).

Figure 1. Details are necessary for implementation phase.



It is important to note that the pattern publications listed above represented the state of the art at the time of publication, and in many cases contain information that is still useful. The spirit of the intent of the *Lighting Solutions* is not to replace or compete with the existing pattern tools, but rather to update and create a new delivery system and increased depth to maximize the use of the advice.

Specifically, the Advanced Lighting Guidelines (ALG) are being updated in concert with the development of the *Lighting Solutions*, such that the new solutions in the applications chapter of the ALG are synchronized with the *Lighting Solutions* (see below). The tools will be hyperlinked to each other, offering different levels of detail for the same designs. The DesignLights Consortium Know-How Series has been graciously donated to the CLS project by

the Northeast Energy Efficiency Partnerships (NEEP) and their member utilities, and material that remains current is being integrated into the ALG and *Lighting Solutions*. Importantly, selected authors from each of the pattern tools listed above are involved in the creation of the *Lighting Solutions*, to ensure continuity wherever possible.

Lighting Solutions are the Next Innovation

The way to break through the powerful market obstacles and achieve the energy savings potential is with the next innovation in best practices for lighting using web-based, actionable solutions as found in the *Lighting Solutions*. At the core of this innovation is the transparent process by which the solutions were developed, the expertise that underlies the designs, the specificity and quality of the guidance, and the interactive delivery mechanism.

Development of the Lighting Solutions

The process to develop the *Lighting Solutions* includes a combination of design charrettes and roundtable meetings for each of the sectors. Charrette attendees include lighting designers, architects, representative manufacturers, and core CLS team members. Roundtable meetings are geared towards stakeholders who review the content of the *Lighting Solutions* as they are developed and provide suggestions for deployment opportunities. Presentations by the attendees of the charrettes are given, and feedback is gathered from end users and other stakeholders.

Once the initial charrettes have occurred, the remainder of the design development process is quite typical. The lighting designers continue development of the solutions to include modeling and documentation. The designs are then implemented within CAD drawings, point-by-point lighting calculations are run to determine the appropriate spacing and mounting heights for the various lighting fixtures, and drawings are submitted.

Once the *Lighting Solutions* are developed in sufficient detail, a larger peer review is conducted to give additional stakeholders a chance to have input. Peer review is sought for the designs, controls strategies, the performance specifications for the luminaires being used in the solutions, as well as the energy analysis, economic calculator, and webtool.

Lighting Solution = Design Vignette + Controls Strategy

Once the designs have been modeled and the documentation is complete, the designs are excerpted from the whole building into “design vignettes” associated with particular building areas. For example, a grocery store will have numerous areas such as general sales aisles, produce, deli, and point-of-sale. There are typically 2-3 design vignettes per store area. The energy consumption for each vignette, along with the potential controls strategies for each vignette, are input into the energy analysis engine of the webtool, along with all the necessary drawings, graphics, description, performance specifications, and implementation information.

Lighting Experts Provide Expert Solutions

Credit for the technical and design content of the *Lighting Solutions* goes primarily to the expert lighting designers who develop the solutions. Working with the International Association of Lighting Designers (IALD) and a team of their members was the key to accessing numerous

strategies to save energy including integration of high performance products, expert electric and daylighting design, lighting controls, and installation and commissioning guidance.

Inevitably, success in a challenge of this nature depends on the ability to achieve a balance between flexibility and specificity. The goal is to strike a middle ground where the *Lighting Solutions* are actionable without being unduly constraining. The lighting design teams are challenged to do the following:

- synthesize many design options into a small number to capture majority of market sector
- determine how much of the design element to include/exclude (layouts/spacing, room geometries, etc.), given the reality that every application is different
- describe the designs in a generic manner that is still specific enough to be actionable
- resolve the use of some of the more innovative technologies while being sufficiently inclusive of different manufacturers
- use controls with high likelihood of success and where data is available
- optimize the possibilities for demand response strategies wherever possible

The Tension Between Energy Efficiency and Lighting Quality

There is a long-standing tension between energy efficiency and lighting quality that has both real and perceived aspects. In the simplest terms, the most efficient luminaire is a bare light bulb (lamp). However, bare lamps are not an appropriate way to light commercial spaces. Inappropriately shielded sources are both glaring and ugly, and also would not be deemed acceptable to occupants or end users in any of the commercial sub-sectors. So, technically speaking, quality has an efficiency cost that is demanded by end users for aesthetic, performance, and safety reasons. The challenge is to create energy efficient solutions that do not require a sacrifice from end users.

After many years of reducing power density levels in the various codes and standards, the codes committees, professionals and public at large are generally in agreement that we have hit the reasonable limit of reducing watts per square foot for most space types and buildings. Further reductions could compromise the engineering “standard of care” as determined by the Illuminating Engineering Society of North America (IESNA).

Does this mean that the savings opportunities from lighting have all been captured? Not at all, but it does mean that creative thinking is in order, and that we now need to shift towards the increased use of lighting controls and daylighting as the next opportunity set. For this to happen, the metric for energy savings must shift from connected load measured in watts per square foot to the use of energy over time in kilowatt-hours.

Criteria for Lighting Solutions

In order to ensure that the *Lighting Solutions* provide both quality and energy savings, criteria were developed to guide the work of the lighting designers, architects and manufacturers. Following is a list of criteria that are applied to the development of the *Lighting Solutions*.

- *Lighting Solutions* shall meet the current engineering standard of care as specified in the IESNA Lighting Handbook, 9th edition dated 2000. (IESNA, 2000)

- Designs will be as energy efficient as possible, while offering a range of reasonable choices to meet the varying needs and budgets of the end users.
- Designs shall be developed in close consultation with end users to ensure their ultimate acceptance and usage.
- Design guidance shall be developed by lighting designers and architects with input from manufacturers, and receive peer review from the relevant stakeholder audiences.
- The technical guidance should provide appropriate assumptions, caveats and rules of thumb such that the use of the guidance takes existing conditions into account.
- Information about the *Lighting Solutions* shall be made available at various levels of detail and tuned to various audiences including building owners, managers, architects, engineers, designers and lighting installers.
- Designs and specifications should maintain an aggressive posture yet be tempered by reality of the market.
- Guidance should incorporate specifications for controls and commissioning to manage human factors and daylighting to achieve optimal efficiency gains.
- *Lighting Solutions* shall be actionable and appropriately aligned with utility programs/incentives and tax credits.

Specifications are Actionable by Nature

In order for the end user and their design team to take action and use the *Lighting Solutions*, supporting information must be provided to bridge the gap from concept to execution. For this reason, a great deal of specificity is provided within the Implementation Instructions packet that is made ready for download by the user at the end of the selection process. Following is a list of the information that is included in the download packet.

- Vignette Summary of information from the webtool screens, including perspective sketches and Reflected Ceiling Plans (RCPs)
- Vignette Implementation pages including RCPs with luminaire tags (unique designations for each luminaire type)
- Given conditions and modeling assumptions, including ceiling height and type, shelving height and spacing, reflectances, lighting loss factors
- Guidance on applying this vignette to your project,
- Luminaire spacing information and mounting heights
- Rules of Thumb
- Maintenance and operations guidance
- Guidance on lighting controls, installation and commissioning
- Luminaire Schedule including luminaires found in selected design vignettes

When the goal is to get an efficient design installed, success ultimately depends on the quality of the specifications. The more vague the specification, the more the various supply chain channel masters will fill in the blanks with equipment that is less expensive and less efficient. Generally speaking, better products will mean less profit for those in the distribution chain and the contractors. There will always be a push to substitute “equal” products for what is specified, also known as “value engineering.” The problem with this approach is that the

“equal” products are rarely equal in performance. Differences that may be subtle to the non-expert are exactly where the energy efficiency is found.

For this reason, the Luminaire Schedule provided with the *Lighting Solutions* provides the exact ANSI designations for lamps and ballasts that are used for the Design Vignettes as chosen by the end user.

The process of developing performance specifications for the luminaires contained in the *Lighting Solutions* has proven to be more of a challenge than for lamps or ballasts, due to the great photometric diversity of products, even within similar distribution categories. The development team will be working closely with the National Electrical Manufacturer’s Association (NEMA) to update the *Lighting Solutions* with greater specificity about the photometric performance of specific luminaires within the context of the design vignettes. This will allow the *Lighting Solutions* to differentiate between average products and premium products that offer improved energy efficiency in a way that has industry support.

Limits of the Lighting Solutions

In addition to describing what the *Lighting Solutions* do, it is important to clarify what they do **not** do. First, it would be impossible to provide design solutions for all types of spaces, so choices are made to pick the most typical spaces and use assumptions that will yield the greatest market uptake. This will inevitably mean that some end users will need designs that are not represented in the *Lighting Solutions*.

This does not mean that the end user who has developed their own design gets no benefit out of the program. The webtool allows users to input their project information for any design (including power density and lighting controls information) to get documentation of savings against a baseline of their choice. End users do not have to use a CLS-developed *Lighting Solution* in order to get documentation of progress towards their green goals or access to utility or efficiency program incentives.

Second, the *Lighting Solutions* is not a stand-in for professional services. The use of an architect, engineer, and/or a lighting design consultant is still a necessary part of any building design and construction process. The solutions need to be incorporated into project drawings, and it is understood that there will be changes made as that process happens. The point of the solutions is to support design professionals and make it easier for them to achieve a low-energy design. Using the *Lighting Solutions* rather than standard practice as a starting point will yield a significantly better result, for the same amount of work by a professional team.

Finally, the *Lighting Solutions* can only analyze what has been measured. In particular, reliable data measuring energy savings from lighting controls systems is not easy to come by. There are many lighting controls systems that could be included if only there were sufficient data to prove their savings. As additional controls savings data becomes available, more controls strategies will be incorporated into the solution set and webtool.

Using the Lighting Solutions – The Webtool

The novelty of the *Lighting Solutions* is only partly in the solid design guidance. Equally important is the fact that the solutions are accessible via the web, are offered within the context of a dynamic decision tool geared towards the end user and A&E audience, and provide energy savings analysis against a baseline of the user’s choice.

Web Tool Decision Path Guides the User

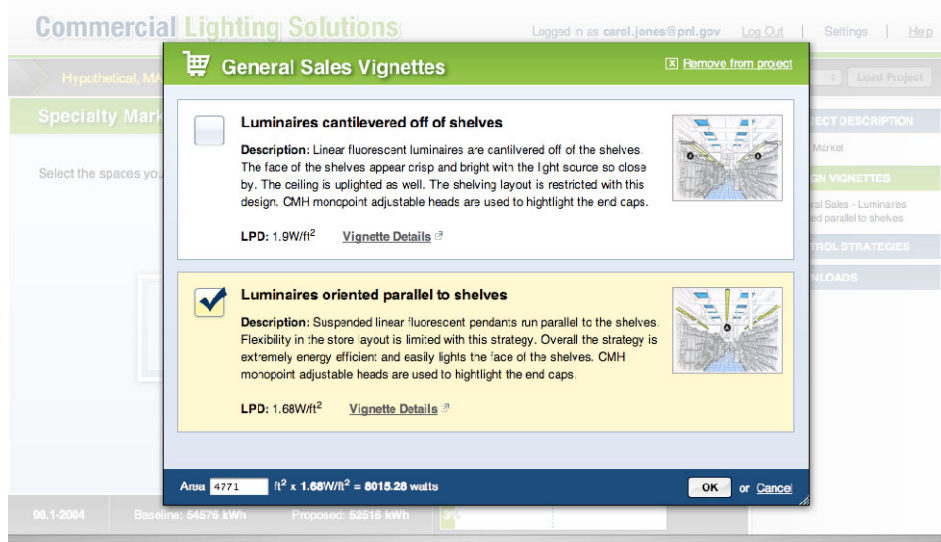
The *Lighting Solutions* are delivered to the market via a webtool that guides end users through a decision process to help them make the best choices for their needs. The webtool guides, analyzes, and measures. The use of the webtool as a delivery and communication device creates a bridge between theory and action because it allows for a dynamic decision process and flexibility of use by the end user. It also allows the content to evolve in a continuous improvement process.

Using the website as the portal for delivery also allows for marketing and outreach, education and training of the end user and-- importantly-- the ability to measure the energy savings against a baseline. The website will be the central repository for everything related to the *Lighting Solutions*, and will be hyperlinked to utility programs and other participating CLS partners. The webtool is also critical for capturing impact and usage of the solutions. The webtool will track the market uptake of the *Lighting Solutions* by soliciting information (type of company, project type, anticipated energy savings, user surveys, etc.) from users downloading materials.

The webtool includes the following elements: (1) home page information and introduction, (2) user registration, (3) input screens to provide project info about building type, square footage, operations, baseline, etc., (4) a decision-tree process to guide user selections based on key plans, design vignettes, controls strategies, lighting equipment specifications, calculation examples, and implementation guidance, (see Figure 2), (5) input screens to collect actual project data based on design documents, (6) energy savings summary page showing savings in kW and kWh, (7) link to download documentation about the selected *Lighting Solutions* along with implementation instructions, (8) linkage to utility and energy efficiency programs where appropriate for rebates and incentives. Future versions of the webtool will also include an economic and carbon savings calculator, and an archived video orientation to walk users through an example project.

Figure 2. Screen Captures of the Webtool—Key Plan and Vignette Selection





Energy Analysis

The energy analysis engine within the webtool assesses the energy consumption of the *Lighting Solutions* including the savings associated with integrated design, daylighting and controls. This involves developing baselines for the purposes of showing energy savings against goals. Numerous baselines have been included in the first release of the webtool including ASHRAE/IESNA Standard 90.1 and the International Energy Conservation Codes (IECC) for various years, but it is recognized that other stakeholders will need other baselines such as California's Title 24, and CBECS. Over time and as resources are made available, the webtool will expand baseline options to meet end user needs.

Saving Energy Over Time

For utilities to incorporate *Lighting Solutions* into their incentive and rebate programs, it is necessary to know how much energy is saved, both with respect to connected load and energy savings over time. Towards this end, each *Lighting Solution* is analyzed to assess the power density as well as the savings associated with various types of control systems given historical performance, installation and commissioning issues. Both empirical data and sources of research on lighting controls are used and numerous scenarios related to the use of lighting controls are analyzed. All assumptions made in the analysis are available to allow for transparent review by stakeholders and users.

Energy Savings Potential

A technical energy savings potential estimate was developed using the CBECS data to determine the projected impact of the CLS. Technical estimates are typically developed to assess the raw potential of a program, which of course will differ from practical application. The 2006 Buildings Energy Data Book developed through the Department of Energy's Energy Efficiency and Renewable Energy office (EIA, 2006) provides details on the building stock across the nation including total square footage and energy consumption. The Energy Information Administration through its Nonresidential 1986 Buildings Energy Survey provides estimates of the typical operating hours for various commercial building types.

The savings goal of 30% improvement over the ASHRAE/IESNA 90.1-2004 Energy Standard was assumed for specific commercial applications. An adjustment was made to the total square footage data to account for the technical penetration potential of lighting system technologies into the existing buildings stock. Adjustments were applied at 50% for retail, education, healthcare, and office. This produced an estimated technical potential savings of 0.114 Quad BTU savings in site energy per year.

Pathway to Incentives

Once the project team has applied the *Lighting Solutions* in the design process, they will develop design and contract specification documents. It is understood that changes will occur between the conceptual selection of vignettes and controls and the final designed project. At this point the end user can return to the webtool to input their actual project information including their luminaire schedule, designed power density and specified controls. With this information, the webtool will generate a report showing their anticipated energy savings in both kW and kWh. This can be taken to utilities and energy efficiency programs to request incentives.

Rebates and incentives by utilities for lighting *systems* rather than components will address the first cost barrier, representing a significant shift in utility program design and an opportunity to get traction in the market for advanced systems.

Market Strategies

A key focus of the CLS program is coordinating with various stakeholder groups to market advanced lighting efficiency in the commercial sector. To achieve this, the CLS team will work with stakeholders all along the value chain (e.g. manufacturers, distributors, utilities, energy efficiency program sponsors, NGOs) to participate in the program and create consistency and widespread support for the use of these energy efficient commercial lighting best practices.

Partnership Model

To achieve the aggressive goals of the CLS, DOE will actively partner with key stakeholders in the lighting and energy industry who have the capacity to raise awareness and, ultimately, influence the decisions of lighting buyers in the commercial market. The team will work with stakeholders to maximize the use of the *Lighting Solutions* in their respective programs and organizations. Partnership-building supports both the technical development and the deployment areas of the program. Partnerships will include pilot demonstrations and numerous other energy efficiency efforts to create the greatest possible leverage of the CLS effort.

Pilot Demonstrations

One strategy to gain market uptake is pilot projects to demonstrate the value of the *Lighting Solutions*. Selection criteria for pilot demonstrations includes: (1) strategic value for the Initiative, (2) applicability to the market sector, (3) value to partners, and (4) ability to create “buzz.” Critical to the success of the pilot demonstrations is measuring the actual energy performance of the *Lighting Solutions*.

Advanced Lighting Guidelines

Another key element of market strategy is access to the marketplace. In the context of the CLS, the Advanced Lighting Guidelines (ALG) and its host organization New Buildings Institute (NBI) are an integral strategic element of the overall effort. The ALG is a product with a strong history that includes high quality technical guidance, expert authorship, broad public and private support, and peer review input. USDOE has always been a sponsor and supporter of the ALG since its inception in 1989. In order to take advantage of the strong marketplace connection and well-established audience, the new ALG applications chapter will be composed of updated applications modules that are based upon the *Lighting Solutions*. The patterns, or modules, found in the ALG applications chapter will present the designs at a conceptual level while the *Lighting Solutions* will provide actionable, detailed specifications to bridge the gap between the traditional design guide and high volume implementation.

Office of the Future

Another key strategic partnership for CLS is the Office of the Future (OTF) project, spearheaded by Southern California Edison with numerous high profile utility members. OTF is a research and applied development project with a mission to find new ways to significantly improve the energy efficiency and demand response of office buildings. The *Lighting Solutions* for offices are developed in collaboration with the OTF project, which provides a mutual benefit for each project. An area of particular importance to the OTF team is advanced controls, including two-way communication with the grid and demand response strategies. These are high priorities to our utility partners.

Leveraging for Maximum Impact

Success in this effort will depend on the creation of significantly greater “leverage” in the commercial lighting efficiency arena. Utilities and efficiency program sponsors will, by some accounts, invest over \$500 million in commercial lighting programs in 2008. Manufacturers will invest significant resources in marketing “tax credit ready” solutions to their customers. Other groups, including NGOs such as the New Buildings Institute and the American Institute of Architects will invest significant resources providing technical guidance to their members and stakeholders on the proper way to design and implement advanced lighting projects in end-user spaces. Under the “umbrella” of the CLS, DOE seeks to provide a means by which these efforts can be more effectively coordinated to achieve maximum impact.

DOE will be looking for partners that are considered front runners in energy efficiency, have a demonstrated track record of implementing energy efficiency initiatives and have the resources (money, square footage etc) to create significant impact to achieving the goal of 30% improved efficiency over ASHRAE 90.1-2004.

Conclusion

In conclusion, the *Commercial Lighting Solutions* provide actionable “how to” guidance on ways to improve building interior energy efficiency and reduce energy consumption, without compromising quality design criteria. Strategies include the use of high performance

commercially available products, daylighting, and lighting controls, all within the context of integrated designs supported by performance specifications. By using strategic partnerships to deploy the *Lighting Solutions* into the marketplace, integrated lighting design is made scalable for increased usage in the mainstream.

References

- [EIA] Energy Information Administration, Annual Energy Outlook 2007. *Buildings Energy Databook*, 2007. Table 1.3.3. <http://buildingsdatabook.eren.doe.gov/docs/1.3.3.pdf>. Washington, D.C.
- [NBI, 2007] New Buildings Institute. 2007. *Getting to Fifty Summit, Final Report*. http://newbuildings.org/gtf/documents/GT50_Summit_Final_Report.pdf.
- [NBI, 2006] New Buildings Insitute. 2006. *Getting to Fifty Buildings Database*. <http://www.newbuildings.org/gtf/documents/AboutTheDatabase.pdf>
- [IESNA, 2000] Illuminating Engineering Society of North America. 2000. *The IESNA Lighting Handbook, 9th Edition*. IESNA, New York, NY.