

**Solid State Lighting Program**  
**Commercialization Support Pathway**

**U.S. Department of Energy**

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Building Technologies Program  
Energy Efficiency and Renewable Energy  
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## **I. SSL R&D Investment Leads to Technology Commercialization**

The U.S. Department of Energy has made a long-term commitment to develop and support commercialization of solid state lighting (SSL) for general illumination, including sources, fixtures, electronics, and controls. In August 2005, President Bush signed the Energy Policy Act of 2005 (EPACT 2005), the first national energy plan in more than a decade. Title IX (Research and Development) of the Energy Act directs the Secretary of Energy to carry out a Next Generation Lighting Initiative (NGLI) to support research, development, demonstration, and commercial application activities for SSL.

The Secretary is also directed to carry out research, development, demonstration, and commercial application activities through competitively selected awards. The Energy Act authorizes \$50 million to the NGLI for each fiscal year 2007 through 2009, with extended authorization to allocate \$50 million for each of the fiscal years 2010 to 2013. The actual Congressional appropriation for the NGLI will not be determined until fiscal year 2007.

This public R&D investment serves the ultimate goal to successfully commercialize the technologies in the buildings sector, where lighting accounts for more than 20 percent of total electricity use.

Potential benefits are enormous if SSL technology achieves projected price and performance levels:

- By 2025, SSL could displace general illumination light sources such as incandescent and fluorescent lamps, decreasing national energy consumption for lighting by about 0.45 quads annually, that is, enough energy saved to serve the lighting demand of 20 million households today.
- The cumulative energy expenditure savings from 2005 to 2025 would translate into more than \$25 billion dollars saved.
- The cumulative energy savings from 2005 to 2025 is projected to be more than 1.5 quads.

To realize the full promise of solid-state lighting by 2025, major research challenges must be addressed. To help tackle these challenges, DOE is funding selected R&D to improve energy efficiency and speed SSL technologies to market. Projects are selected to align with a comprehensive R&D plan developed in partnership with industry, research and academic organizations, and national laboratories. DOE has and will continue to maintain a focus on the ultimate goal of supporting commercialization of SSL technologies to decrease lighting energy use while improving and expanding lighting services. Unique attributes of SSL technologies underscore the importance of a long-term, coordinated approach encompassing applied research and strategic technology commercialization support.

Effective market introduction of SSL technologies must be informed by and coordinated with the applied research currently underway. As R&D progresses, SSL technologies will attain performance levels that make them appropriate and advantageous for various

applications. For example, the energy efficiency and longevity of monochromatic LEDs now make them the obvious choice for traffic signals, exit signs, airport taxi-way lighting, and many other niche applications. As a result of extensive R&D, white-light LEDs have recently attained performance levels that begin to make them appropriate for use in automobiles, aircraft interiors, and some display applications. For most general illumination applications, current white LEDs cannot yet compete with traditional light sources on the basis of either performance or cost, but the technology is evolving rapidly. The timing and targeting of commercialization support efforts is as important to the ultimate success of SSL as current R&D investment. For this reason, DOE has created a comprehensive commercialization support plan, drawing on a variety of strategies to assist the market introduction of high-quality, energy-efficient SSL technologies.

## **II. Commercialization Support Strategies**

DOE has a long-term vision for commercialization support of SSL technologies. Over the coming years, SSL technologies for general illumination will continue to improve and evolve, with luminous efficacy increasing and unit costs decreasing. Appropriate commercialization support strategies will be determined by the status of the technology relative to particular applications. Beginning in 2005, DOE initiated several activities as part of the long-term plan.

### A. Activities in Progress

#### ***Partnership with Industry***

EPACT 2005 directs DOE to partner, through a competitive selection process, with an Industry Alliance that represents U.S. SSL research, development, infrastructure, and manufacturing expertise. DOE is directed to solicit Alliance assistance in identifying SSL technology needs, assessing the progress of research activities, and updating SSL technology roadmaps. In fulfillment of this directive, DOE signed a Memorandum of Agreement with the Next Generation Lighting Industry Alliance (NGLIA) in 2005. Alliance members include the major US-based manufacturers of LEDs, OLEDs, components, materials, and systems.

#### ***ENERGY STAR for SSL***

DOE has initiated development of ENERGY STAR criteria for white LED-based lighting products. DOE envisions a two-category criteria, with the first category (Category A) covering a limited number of general illumination niche applications for which white LED systems are appropriate in the near-term, and the second category (Category B) intended to cover a wide range of LED systems for general illumination. Category B will serve as the longer term target for the industry. Initial applications eligible under Category A will include those with the following characteristics: 1) appropriate for a light source with a directional beam, as opposed to a diffuse source; 2) low to moderate illuminance requirement; 3) illuminated task or surface relatively close to the light source; and 4) potential for cost-effective use of LED-based products in the near term.

### ***Support for Standards Development***

Solid state lighting differs fundamentally from incandescent, fluorescent, and HID lighting technologies. The materials, drivers, system architecture, controls, and photometric properties of SSL differ from traditional lighting technologies. A host of new test procedures and industry standards is needed to accommodate these technical differences. DOE is engaged in ongoing dialogue with the relevant standards organizations, and has offered technical assistance in the development of new standards.

### ***Design Competition***

DOE is one of the organizing sponsors of Lighting for Tomorrow (LFT), along with the American Lighting Association and the Consortium for Energy Efficiency. LFT design competitions in 2004 and 2005 were successful in encouraging, recognizing, and publicizing excellent new designs for energy-efficient residential decorative light fixtures. In 2006, LFT is introducing a new competition for LED products in specific niche applications. Working prototype fixtures will be evaluated by an expert judging panel which will select winners on the basis of lighting quality, energy efficiency, fixture design, and style.

### ***Outreach to Federal Programs***

As the largest single purchaser of lighting products in the nation, the federal government can play an important role in demonstrating new technologies. Recently, DOE has made provided information to more than 30 federal agencies through presentations to the Federal Utility Partnership Working Group, the Interagency Energy Management Task Force, and the Federal Energy Efficiency Working Group.

### ***Technology Tracking and Information Services***

DOE continues to track performance improvement in LED and OLED technology over time. DOE also maintains a database of available white LED-based niche lighting products available in the market. This information is used not to publicize individual products, but to provide general information about pricing and availability trends of LED products.

### ***Consumer and Business Awareness Programs***

DOE has developed informational materials on LED technology and products for a general consumer and business audience. A two-page fact sheet covering basic technical issues related to LEDs was disseminated at GreenBuild, the National Weatherization Training Conference, Energy 2005, and other events. Additional information of use to consumers and businesses is available online via DOE's SSL website at [www.netl.doe.gov/ssl/](http://www.netl.doe.gov/ssl/).

### ***Utility Promotion and Incentive Programs***

Through ongoing communication with the Consortium for Energy Efficiency, which represents utilities, state energy offices, and regional energy efficiency organizations, DOE provides information and seeks feedback from the utility/energy efficiency sector on commercialization of SSL technologies.

## B. Planned Activities

In addition to the activities already underway, DOE is planning a range of other initiatives that will support commercialization of SSL technologies and products. These include the following:

### ***Technology Procurement***

Technology procurement is an established process for encouraging market introduction of new products that meet certain performance criteria. DOE has employed this approach successfully with other lighting technologies, including sub-CFLs and reflector CFLs. DOE plans to employ technology procurement to encourage new SSL systems and products that meet established energy efficiency and performance criteria, and link these products to volume buyers and market influencers. Volume buyers may include the federal government (FEMP, DLA, GSA), utilities, or various sub-sectors including hospitals, lodging, or retail.

### ***Demonstration and Performance Verification***

DOE will gain real-life experience and data involving SSL installations in various applications through demonstration and performance verification, including measurement of energy consumption, light output, color consistency, and interface/control issues.

### ***Retailer Training Programs***

DOE will develop information and training materials to aid lighting retailers in communicating about SSL technologies with their customers.

### ***Builder Programs***

DOE will develop and deliver technology transfer and training programs to increase homebuilders' awareness and technical knowledge of SSL.

### ***Designer Programs***

DOE will support development of materials and curricula for interior design and lighting design professionals.

### ***Education Programs***

To support development of the next generation of engineers and designers who will implement SSL, DOE will support development of materials and information on SSL technologies for schools, supporting SSL-related projects in the context of class work and science fairs.

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