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U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

## Solid-State Lighting Frequently Asked Questions

March 2011



OAK RIDGE NATIONAL LABORATORY

Managed by UT-Battelle for the Department of Energy

This document was prepared by the Midwest Energy Efficiency Alliance (MEEA) in collaboration with a partnership of companies under the Contract No. 4200000341 with Oak Ridge National Laboratory, which is managed by UT-Battelle, LLC under Contract with the US Department of Energy No. DE-AC05-00OR22725. The partnership is led by the Vermont Energy Investment Corporation (VEIC), and includes the following companies: American Council for an Energy Efficient Economy (ACEEE), Energy Futures Group (EFG), Midwest Energy Efficiency Alliance (MEEA), Northwest Energy Efficiency Alliance (NEEA), Northeast Energy Efficiency Partnership (NEEP), Natural Resources Defense Council (NRDC), Southeast Energy Efficiency Alliance (SEEA), and Southwest Energy Efficiency Project (SWEEP).

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## Solid-State Lighting Frequently Asked Questions

Solid-state lighting provides municipalities with an opportunity for substantial energy savings and better light quality, but the benefits can be difficult to perceive for those without a basic grasp of this exciting new technology.

1. What is solid-state lighting (SSL)?
  2. What are the benefits of SSL?
  3. What are the drawbacks of SSL?
  4. Is now a good time to install solid-state lighting?
  5. What are some good applications for SSL?
  6. How do I know if an investment in SSL is cost-effective?
  7. What quality features should I be looking for?
  8. What questions do I need to ask of a vendor, manufacturer, or contractor?
  9. What other resources are available to assist us in an SSL project?
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### Q1: What is solid-state lighting (SSL)?

**A1:** In most cases, the term *solid-state lighting* refers to light-emitting diodes (LEDs). An LED is an electronic component based on semiconductor technology that emits light when electric current is passed through it. LEDs are not a new technology - they have been in use for approximately 50 years, beginning as colored indicator lamps and later becoming useful in a broad range of applications. In recent years, the brightness, color, and lifespan of SSL has improved to the point where this technology is practical for use in many general, white-light illumination applications.

### Q2: What are the benefits of SSL?

**A2:** Solid-state lighting offers several advantages over many other lighting options.

- **Energy efficiency** – SSL is much more efficient than many existing lighting technologies in converting electricity into visible light. Older lighting technologies typically require a significant amount of energy to produce visible light, with much of the electricity being wasted as heat. Current SSL is approximately five times as efficient as incandescent lighting, and is often more than twice as efficient as technologies such as fluorescent, metal halide, or high-pressure sodium lighting. The efficiency of SSL products continues to improve steadily.
- **Very long life** – The lifetime of SSL compares very favorably with most other lighting technologies. Claims of up to 50,000 hours of lifetime operation are common for SSL. Depending on the amount of daily use, this often translates into a decade or more of operation.

This is a notable consideration for lighting applications that are difficult or expensive to maintain.

- **Directional light** – LED lighting is directional by nature, making it easy to place light exactly where it is meant to fall. Two distinct benefits from the directional character of LED are: (1) light pollution can be reduced through SSL, and (2) overall light levels can be reduced while target areas are provided with essential light.
- **More effective nighttime illumination** – In sites where security and personal safety at night are important, other lighting types frequently offer poor color rendering and are marketed to make users associate more lighting with greater security. SSL provides more effective color rendering and enables better nighttime vision, compared to many other lighting types.
- **Other benefits** – SSL products often work well with electronic controls that enable greater energy savings—for example, timers, dimmers, and occupancy sensors. SSL also can offer improvements over older lighting technologies, including resistance to the effects of vibration, better cold temperature operation, size options, time response to light and re-light, and level of ultraviolet light.

### Q3: What are the drawbacks of SSL?

**A3:** Solid-state lighting is an emerging and promising technology; but as it approaches maturity, several limitations can be noted.

- **Product cost** – In most lighting scenarios, the SSL option is significantly more expensive than traditional technologies. Although SSL lowers energy bills, the higher up-front costs can make it difficult for potential buyers—from individuals to municipalities—who are unable to budget for energy efficiency improvements across a long term.
- **Variable product quality and performance** – Because SSL as a general illumination source is still relatively new, product performance varies. Further, it is not uncommon for manufacturers to overstate claims of performance. Particularly for large-scale purchasers such as municipalities, the lack of critical evaluation of product quality can make it difficult to reach an informed decision about whether to use SSL. (See Questions 7 and 9 for information on how to address these challenges.)
- **Product support** – The very long life of SSL products leaves open the possibilities that current products might not be able to be serviced over their lifetime, or they might not be replaceable with identical products at the end of their lives. With many new manufacturers competing in the SSL market, it can be difficult to predict which ones will be able to provide product support in the future.
- **Learning curve** – SSL introduces new lighting capabilities that can require new technical considerations. Integrating SSL into lighting plans might require special training for

lighting or maintenance staff, and lighting designers might need to understand a new set of performance metrics and design considerations.

#### **Q4: Is now a good time to install solid-state lighting?**

**A4:** There is no single answer to this question. SSL products are still evolving and are likely to become less expensive over time. On the other hand, delaying the installation of SSL delays immediate energy savings and thus lower electricity costs. Elements of prudent decision-making should include cost effectiveness, suitability of SSL for the intended applications, and identification of products that combine high quality and durability appropriate to a budget.

#### **Q5: What are some good applications for SSL?**

**A5:** The list of SSL-friendly applications is growing with each passing year. SSL is currently well suited for difficult-to-maintain, large-scale exterior applications with long hours of operation. This would include street lamping, traffic signals, path / security lighting, sidewalk bollards, wall packs, parking lots, and parking garages.

The range of interior applications suitable to SSL is more limited. Exit signage, cove lighting, flat panels, recessed cans, multifaceted reflectors, task lighting, and effect lighting present good SSL opportunities. Replacing linear fluorescent tubes generally makes less sense, given the higher cost and inferior performance of SSL in applications where fluorescent tubes have been adequate.

#### **Q6: How do I know if an investment in SSL is cost effective?**

**A6:** A good approach to determining if an energy efficiency installation is cost effective is to consider the payback period of the investment—the length of time it will take to recoup your additional investment in efficiency through energy savings. Some factors when determining the length of payback are:

- Product cost
- Financial incentives to install the efficiency measure
- Product lifetime
- Cost of electricity
- Annual hours of operation
- Annual energy use / cost
- Annual maintenance costs

An acceptable payback period is specific to each customer. However, lighting investments with a payback period of fewer than three years are generally viewed as sound investments, whereas paybacks beyond 10 years might be worth reconsidering in favor of energy efficiency upgrades with a faster return on investment.

## Q7: What quality features should I be looking for?

**A7:** There are numerous evaluation groups that provide specifications and product reviews to make it easy to identify high quality in SSL products. The [ENERGY STAR](#)<sup>®</sup> program has begun to apply its label to SSL products in certain categories, and it intends soon to expand its labeling to additional categories. The [DesignLights™ Consortium](#) has tested SSL products against its own set of rigorous specifications. Requiring that contractors and other vendors propose products that contain the ENERGY STAR label, or can be found on the DesignLights Consortium Qualifying Products List, will make it easier to identify products of high quality. The DOE's [Lighting Facts](#) initiative standardizes the labeling and information presented on lighting products' packaging so that energy features of different products may be compared side by side.

Suppliers can erect test installations of their proposed SSL lighting systems, or at least provide a valid computer model of the lighting layout. A first-hand view of system performance can give you a preliminary idea of your satisfaction with your lighting project.

Previous experience with other SSL installations is also valuable for learning the capabilities of your lighting product or contractor. It is wise to ask for references from at least three former clients who have worked with your vendor or contractor on projects similar to your own.

If no references or certifications are available, it might be necessary for you to conduct your own evaluation of proposed equipment and projects. Under these circumstances, you might want to consider manufacturers who have submitted their products to independent LM-79 and LM-80 testing (U.S. DOE resources exist to help you interpret these test results, and qualified lighting contractors might help you understand them, as well).

## Q8: What questions do I need to ask of a vendor, manufacturer, or contractor?

**A8:** Minimize your risk by asking some key questions that will help you to move forward confidently with a project.

For example:

- Are you willing to erect a test installation of your proposed SSL system so that we can see how the final project will look and perform?
- Can you provide a computer model of your product's performance, based on site schematics, to ensure it meets minimum light level requirements, as mandated by local ordinances? Can you verify that you can meet minimum light levels over the full lifetime of the product?
- Can you provide us with product cut sheets that provide information on: color temperature, power factor, on / off power consumption, fixture efficacy and lumen output, Dark Sky compliance / BUG rating, life expectancy, color shift?

- In addition to product cut sheets, can you provide independently tested photometric reports such as LM-79 and LM-80 evaluations?
- What is the product's warranty? Does it cover parts, labor, or both? What is the length of time of coverage? What conditions trigger a warranty claim (e.g., fixture gone dark, portion of LEDs gone dark, light output reduced to X%, or color shift)?
- Can you tell us about options for compatible adaptive controls that might allow for additional energy savings?
- How long have you been in the lighting industry? Whose LEDs are used in your product? Can you provide references?

## **Q9: What other resources are available to assist us in an SSL project?**

**A9:** The U.S. Department of Energy has dedicated several programs solely to assisting those interested in solid-state lighting:

- [DOE Technical Assistance Center](#) – A resource for recipients of State Energy Program (SEP) or Energy Efficiency and Conservation Block Grant (EECBG) funding to gain access to general resources on implementing ARRA-funded energy efficiency efforts, or to make direct requests for technical assistance with specific projects.
- [DOE Municipal Solid-State Street Lighting Consortium](#) – A group serving municipalities seeking information and resources on integrating SSL into their street lighting applications.
- [GATEWAY Demonstrations](#) for Solid-State Lighting – DOE supports learning real-world SSL results through the GATEWAY program, which produces detailed case studies of SSL projects put into place across the country.
- [CALiPER Program](#) – The Commercially Available LED Product and Evaluation Reporting Program (CALiPER) performs independent laboratory testing of commercially available SSL products and presents the results in regular reporting on specific products in each round of testing, as well as general assessments of how SSL products are performing from an historical perspective.
- [Commercial Building Energy Alliances \(CBEA\)](#) – This group's Lighting and Electrical Subcommittee has developed information resources on SSL, including lighting specifications for applications well suited to municipalities.
- [Next Generation Luminaires™](#) Solid-State Lighting Design Competition – An annual competition awarding best-in-class designations to the top products in commercial and municipal applications.
- [DOE SSL Fact Sheets](#) – Brief, simple explanations of SSL topics
- [Lighting Facts®](#) Label – A packaging label, similar to the nutrition label found on food products, to tell consumers what performance to expect from the enclosed product (light output, efficacy, color, etc.)

- [TINSSL](#) – DOE’s Technical Information Network for Solid State Lighting. TINSSL members receive updates on SSL technologies, practices, and developments.

#### Qualified Products Lists

- [ENERGY STAR](#) Commercial SSL Qualified Fixtures – Commercial SSL products that have met or exceeded established standards for quality and performance.
- [DesignLights Consortium \(DLC\) Qualified Products List \(QPL\)](#) – Commercial, qualified SSL products, covering fixture categories not covered by ENERGY STAR.