



DOE Solid-State Lighting Program Overview & Five-Year Commercialization Support Plan

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U.S. Department of Energy

Voices for SSL Efficiency Workshop
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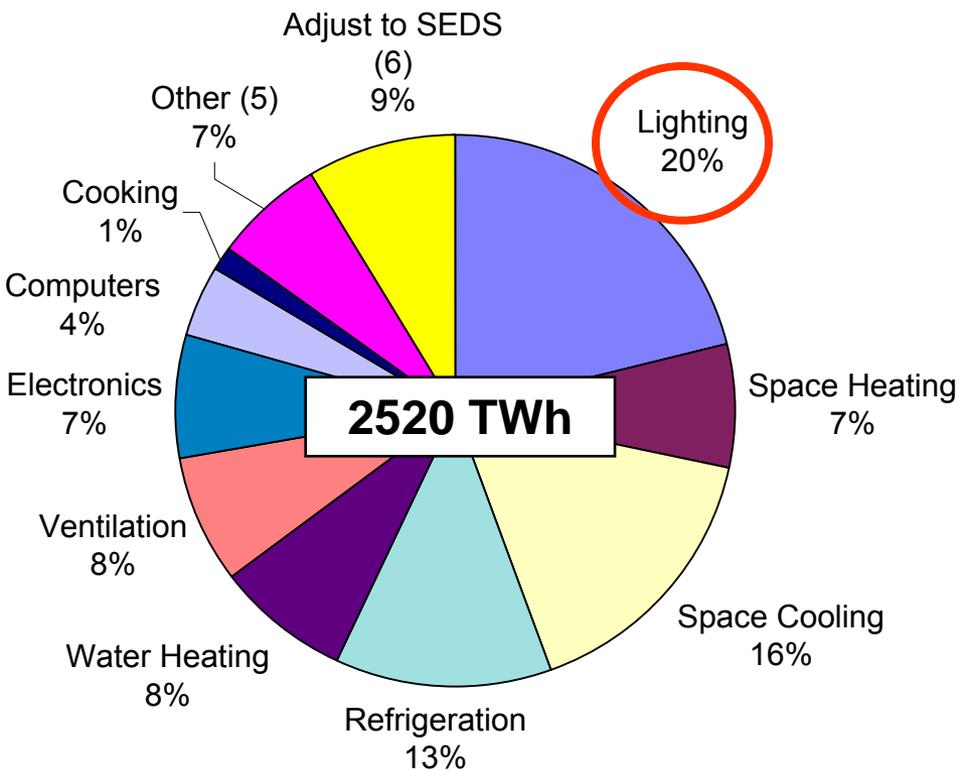
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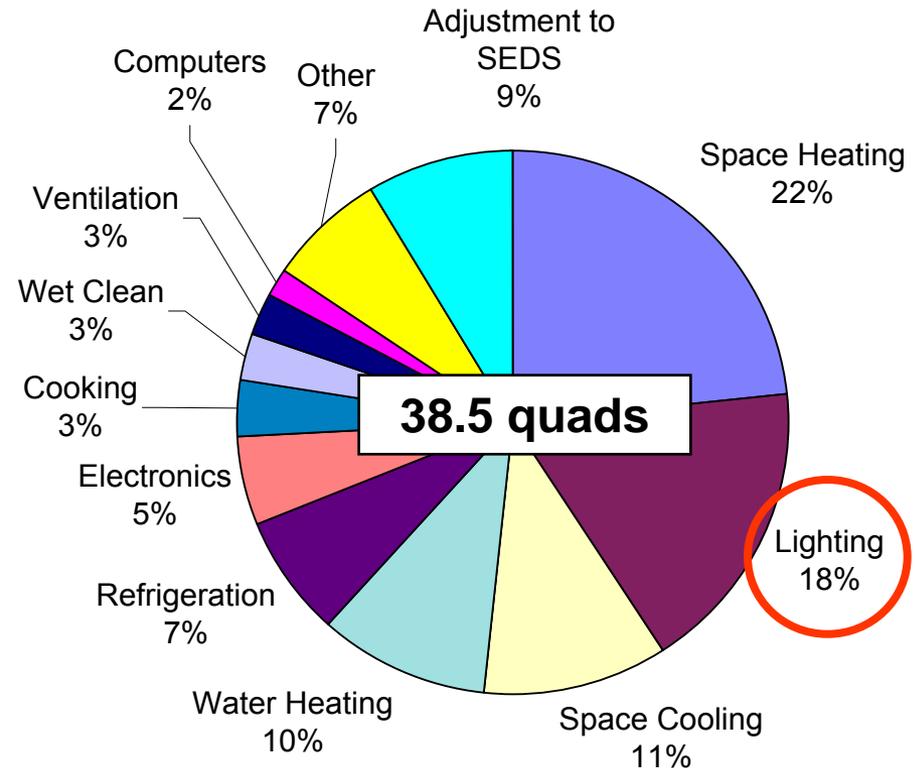


U.S. Buildings Energy End-Use Breakdown, 2004

Site Electricity Consumption



Total Primary Energy (all fuels)





The Legislative Authority

Domenici-Barton Energy Policy Act of 2005

Section 912

“The Secretary shall carry out a Next Generation Lighting Initiative in accordance with this section to support research, development, demonstration, and commercial application activities related to advanced solid-state lighting technologies based on white light emitting diodes.”



SSL Partnership Next Generation Lighting Industry Alliance MOA

“The Parties will conduct activities in support of research, demonstration and deployment of solid-state lighting (SSL) technologies for general lighting applications.”

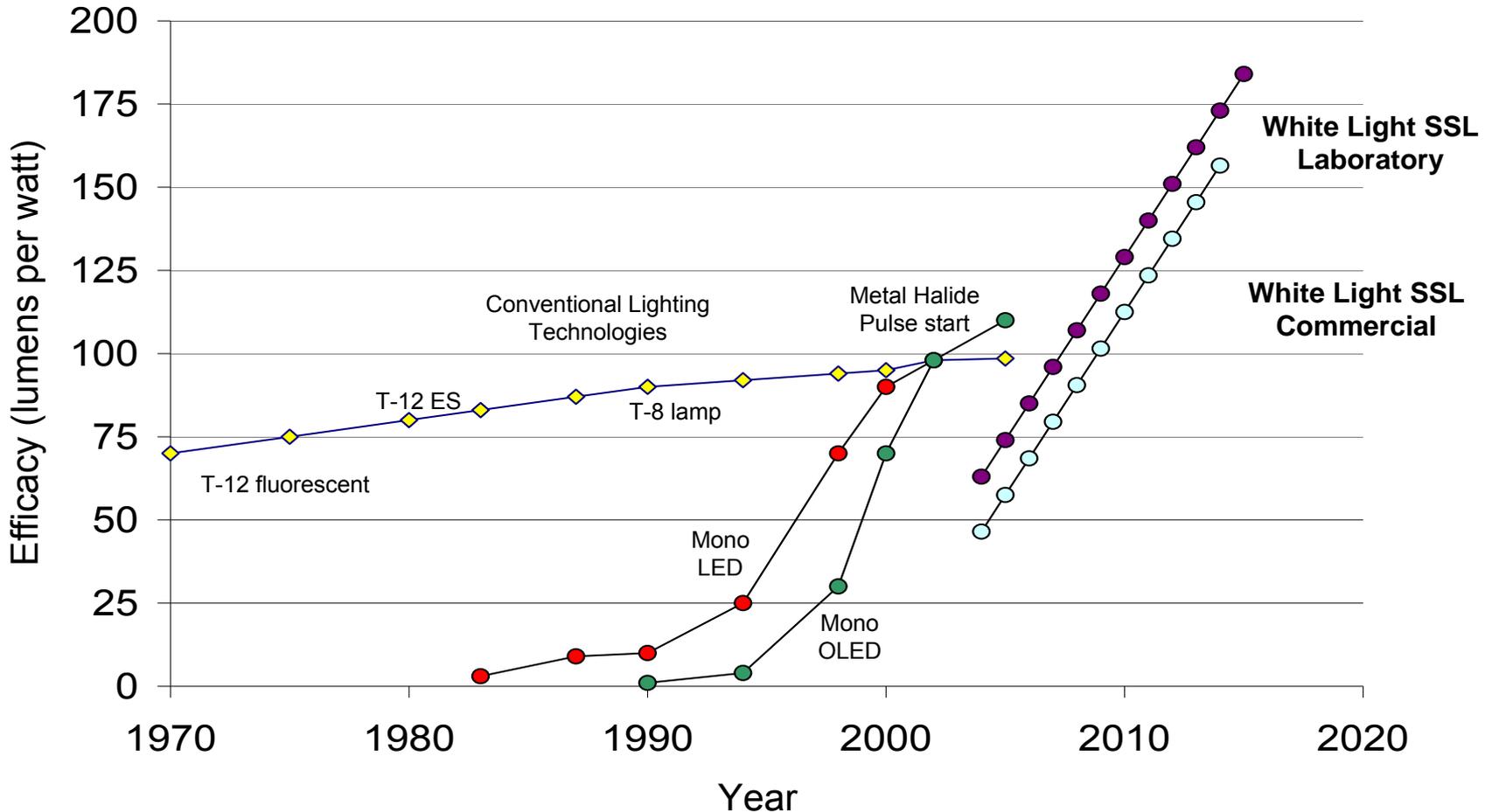
“...create criteria for voluntary market conditioning programs, such as ENERGY STAR®”

Members:

Acuity Brands Lighting ◇ Air Products & Chemicals ◇ CAO Group ◇ Color Kinetics ◇ Corning ◇ Cree ◇ Dow Corning ◇ Eastman Kodak Company ◇ General Electric Company ◇ Light Prescriptions Innovators LLC ◇ LSI Industries ◇ Lumination ◇ OSRAM Sylvania ◇ Philips Electronics North America ◇ QuNano ◇ Ruud Lighting ◇ 3M



Accelerated R&D for White Light SSL



SSL Laboratory and Commercial Curves, revised April 2007



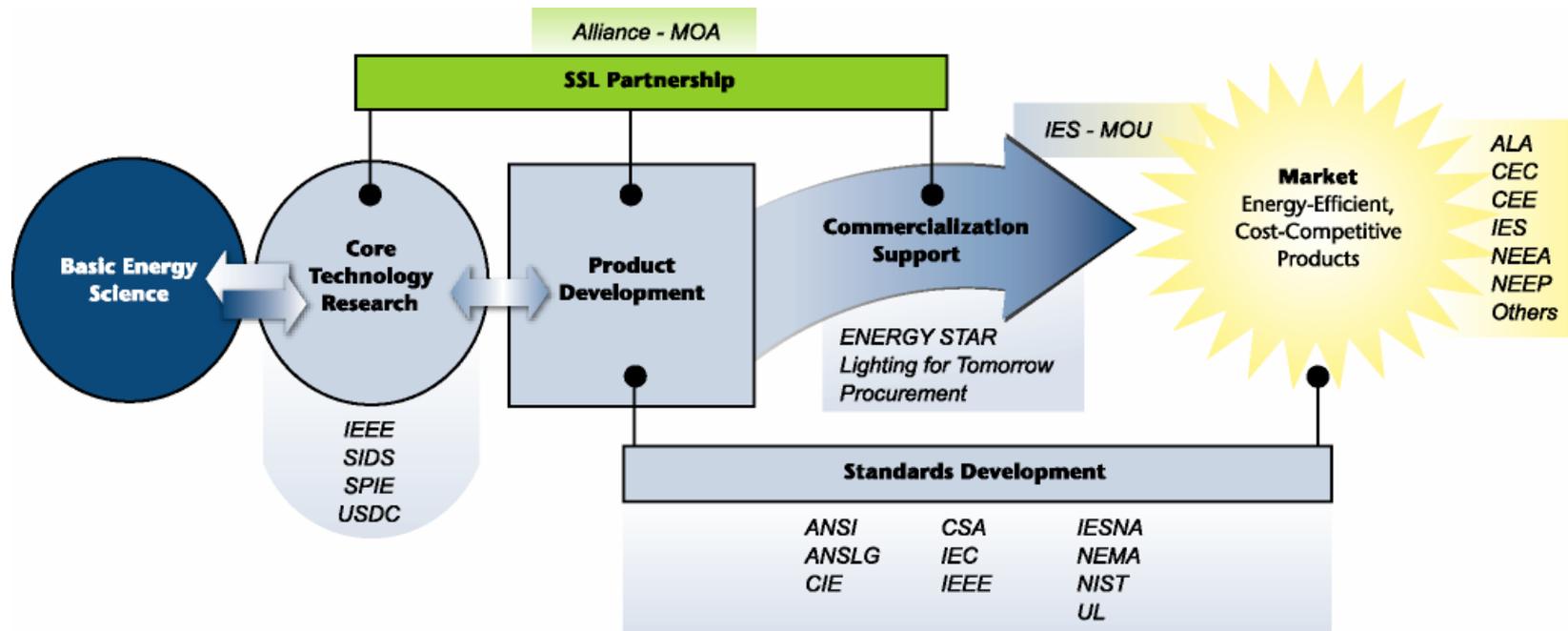
Unique and Potentially Better Technology

- Heat transfer
- Low voltage DC
- Small emitter
- Directional
- Shades of white light





DOE SSL Technology & Market Partners





Illuminating Engineering Society of North America MOU

“Developing and maintaining guides and procedures to assist the lighting measurement and application community in the photometric measurement of solid state lighting devices and other technologies to support DOE programs, including development of ENERGY STAR® criteria for SSL...”

IESNA:

IESNA is the recognized technical authority on illumination, and communicates information on all aspects of good lighting practice to its members, the lighting community, and consumers.
www.iesna.org



Other Federal Agency Involvement – Research

- NIST
 - ATP
 - Optical Technology
- DOD – DARPA
- National Science Foundation
- National Academy of Sciences



Other Federal Agency Involvement – Market Deployment

- USDA
- Commerce
- Defense
- Education
- GSA
- HHS
- DHS
- HUD
- Interior
- Justice
- Labor
- NASA
- USPS
- SSA
- State
- DOT
- Treasury
- Veterans Affairs



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Program Overview

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Commercialization Support Plan



Key Take Away from CFL Experience

- Early consumer experience with fluorescent lamps and CFLs still defines attitudes towards CFLs, even though the technology has greatly improved since its introduction

www.netl.doe.gov/ssl/072806.html





5-Year SSL Plan Purpose

1. *Affect the types* of products adopted by the market
2. *Accelerate commercial adoption* of products
3. Support applications that *maximize energy savings*

Plan Scope

FY08 to FY12 ♦ general Illumination SSL luminaires



Goals: By FY12

1. Products Brought to Market:

Warm White Products

- 68 lm/W luminaire efficacy
- 85 CRI (or similar for revised metric)
- 3500 CCT or less

Cool White Products

- 88 lm/W luminaire efficacy
- 70 CRI (or similar for revised metric)
- 6500 CCT or less

2. Market Adoption: 1 million units/year (ENERGY STAR)

3. Energy Savings: 230 GWh per year



Primary Market Barriers

- High costs
- Lack of industry standards and test procedures
- Lack of information

Note: *Barriers do not address technical barriers, which are being addressed in R&D program.*



Market Needs (to Address Barriers)

- Effective product purchasing and architectural design guidance
- State of the art products and lighting designs
- Highly visible examples of model SSL general illumination applications
- Independent performance test results on commercial products
- Objective technical information from a credible source
- Industry standards and test procedures for SSL general illumination products
- Coordination of local, regional, and federal SSL commercialization activities



DOE SSL Commercialization Support Strategy Elements

1. Buyer Guidance

- ENERGY STAR
- Design guidance

2. Design Competitions

- Lighting for Tomorrow (residential fixtures)
- Commercial Fixture Design Competition
- Architectural Lighting Design Competition

3. Technology Demonstrations/Procurements

- Demonstrations of market readiness
- Demonstrations to test field performance



DOE SSL Commercialization Support Strategy Elements (cont.)

- 4. Commercial Product Testing Program**
- 5. Technical Information**
 - Technical information development and dissemination
 - Technical information network
- 6. Standards and Test Procedures Support**
- 7. Coordination and Leadership**
 - Facilitating and coordinating local and regional efforts
 - Federal government leadership



1) Buyer Guidance

- Developed draft ENERGY STAR criteria for SSL luminaires
- General illumination only
- Residential and commercial products
- Intended to provide early market presence
- 1st draft issued in December 06
- Stakeholder workshop in February 07 in DC
- 2nd draft issued in April 07; final by July 07





Why ENERGY STAR SSL? Why Now?

- Many new products entering market
- Many appear to have greatly exaggerated performance
- DOE SSL commercial product testing is showing actual performance is much less than claimed



Example: Downlight claimed 40 lm/W; measured luminaire efficacy of 13 lm/W and 193 lumens; less than 1/2 the efficacy of typical CFL downlight, and ~1/3 the lumens.



Why ENERGY STAR SSL? Why Now?

- Meanwhile, LED technology is rapidly improving
- Manufacturers are announcing new performance records almost every month
- DOE expects market introduction in 07 and 08 of high performance products

Example: 2700K CCT, 90+ CRI downlight, 60 lm/W (luminaire efficacy); twice the efficacy of a CFL downlight expected 3rd Q 07.



Design Guidance

- Develop SSL design guidance in cooperation with IESNA
- Purpose: provide lighting designers with key information on SSL technology and characteristics to be considered in designs
- Project in development





2) Design Competitions

- Lighting for Tomorrow
 - Partnership with ALA and CEE approved through 2008
 - Niche applications
 - Cutting edge design
 - Residential products only
 - Recently expanded to include SSL
 - Expert judges
 - Publicity, visibility for winners

www.lightingfortomorrow.com





Design Competitions (cont.)

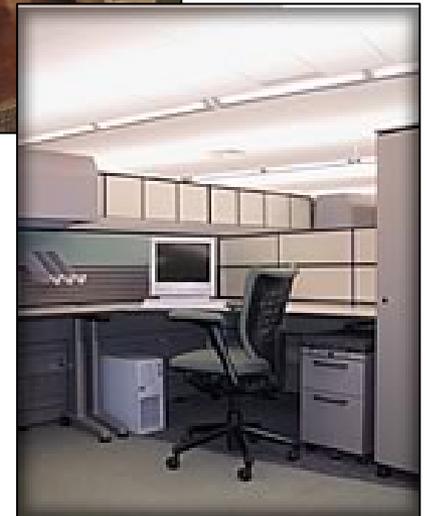
- New commercial luminaires design competition being considered
- Also considering SSL architectural design competition in future
- New competitions being discussed with IES



3) Technology Demonstrations/ Procurements

Purpose:

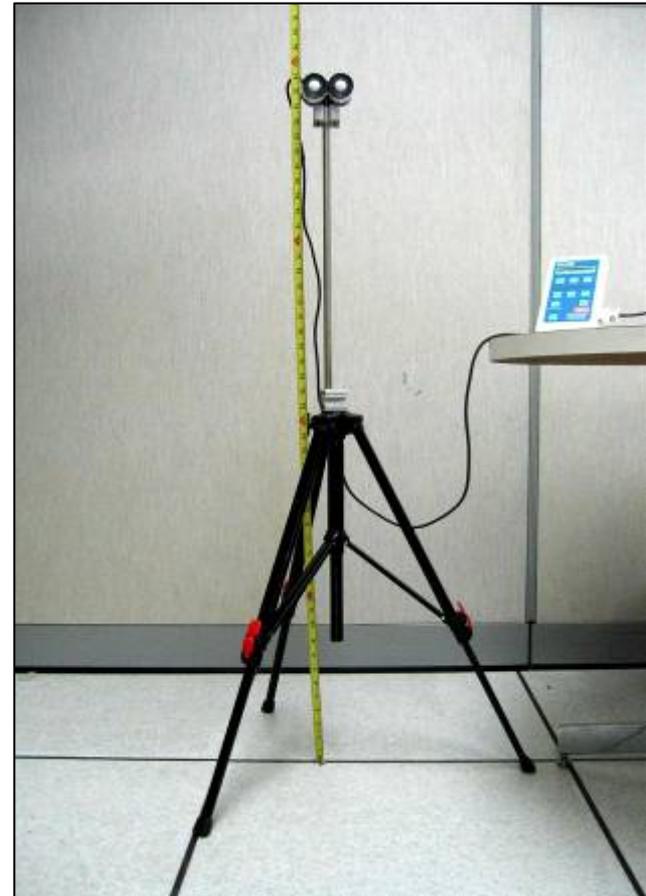
- Demonstrate advanced technology in general illumination applications for visibility and improved understanding
- Leverage demos with closely linked promotional/procurement effort
- Present two types of demos:
 - Market readiness
 - Field test





Technology Demonstrations

- 1st round started
- Invitation issued to manufacturers in March
- DOE finds partners and host sites, conducts testing, publicizes results and helps promote follow-up sales
- Evaluations to focus on light quality, occupant responses
- Next round likely before FY end





Other Technology Demonstrations

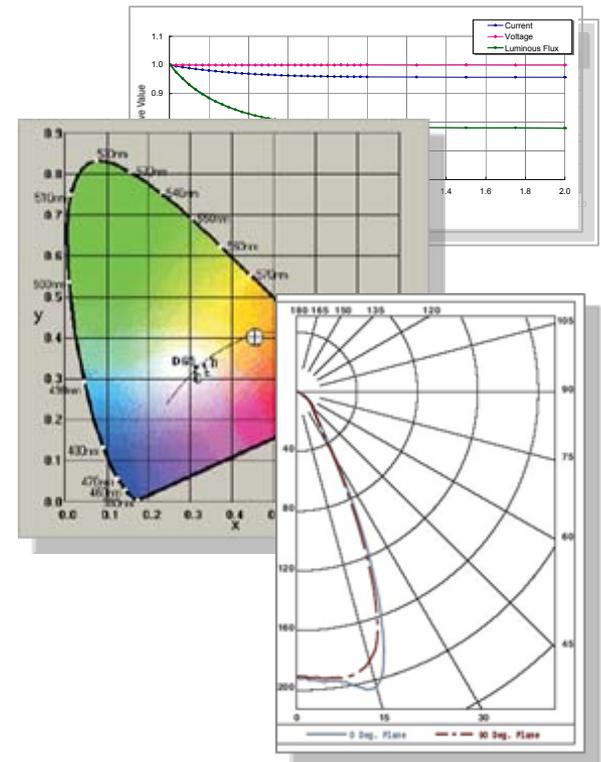
- Solar Decathlon
- DOE SSL Showcase





Testing Program Scope

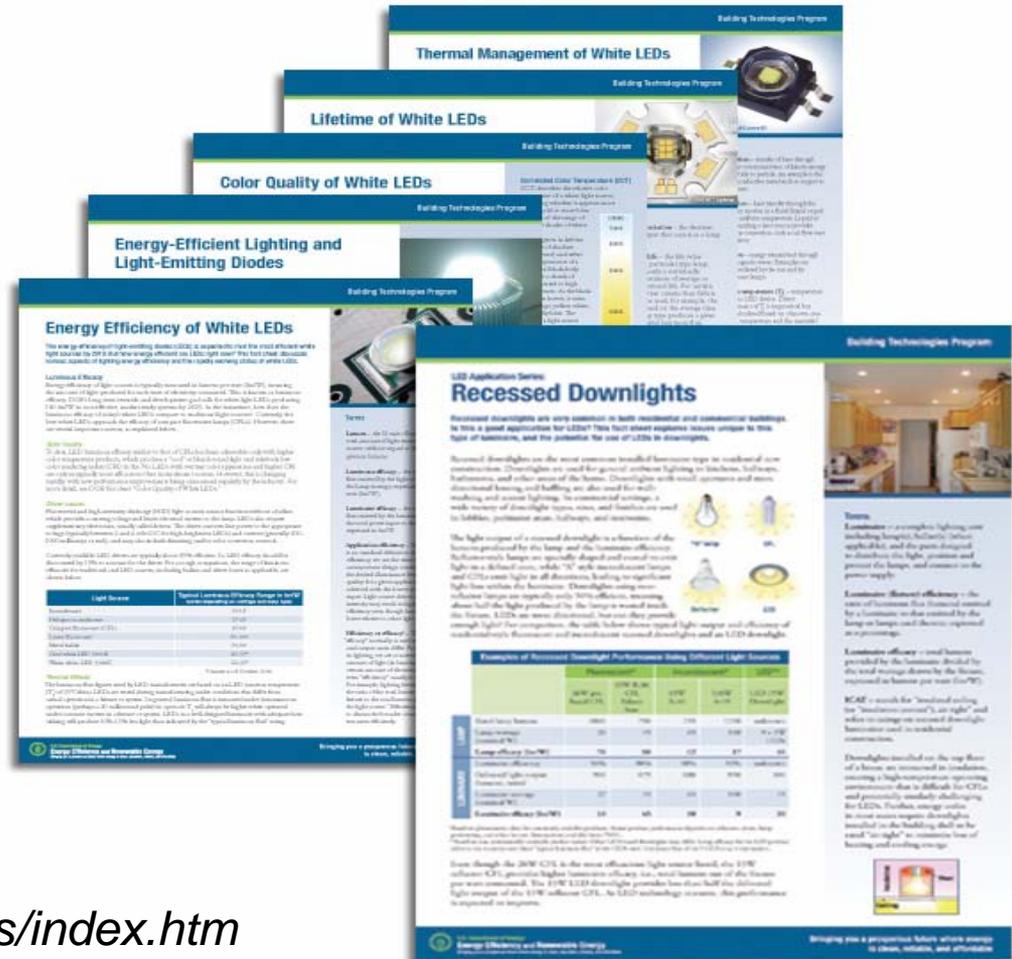
- Commercially-available SSL products for the general illumination market:
 - Luminaires (white light)
 - Indoor and outdoor
 - Residential and commercial
- Testing for:
 - Luminaire light output, efficacy
 - Power, thermal characteristics
 - Beam and intensity
 - Lumen depreciation
 - Spectral power distribution, CCT, CRI
 - Benchmarking (other light sources)
- Test results available:
www.netl.doe.gov/ssl/comm_testing.htm





SSL Technology Fact Sheet Series

- LED Basics:
 - Energy Efficiency
 - Thermal Management
 - Lifetime
 - Color Quality
- Application Series:
 - Recessed Downlights
 - Undercabinet
 - Portable Desk/Task
- Measurement Series:
 - Luminaire Efficacy
- More coming



www.netl.doe.gov/ssl/publications/index.htm



Technical Information Network

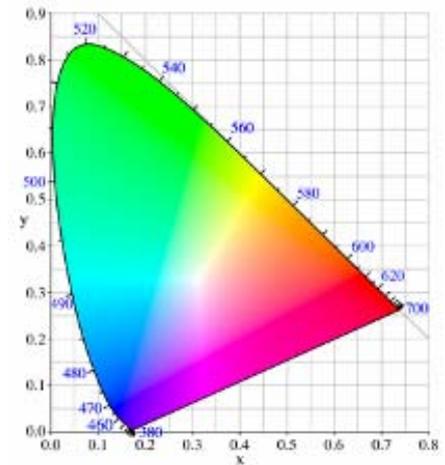
- Cooperative agreements to be awarded to selected partners: CEE and NEEP
- Outreach to efficiency organizations, utilities, and their contractors
- Leverage existing programs and contacts
- Quarterly meetings
- Disseminate information to:
 - Retailers, builders
 - Consumers, others



6) Standards and Test Procedures Support

Key Measurement Issues:

- Measurement of luminous flux
 - Luminous efficacy
 - Luminaire efficacy
- Chromaticity and color rendering
- Electrical characteristics
- Drivers
- Life rating (lumen maintenance)
- Definitions and nomenclature





Standards and Test Procedures Support

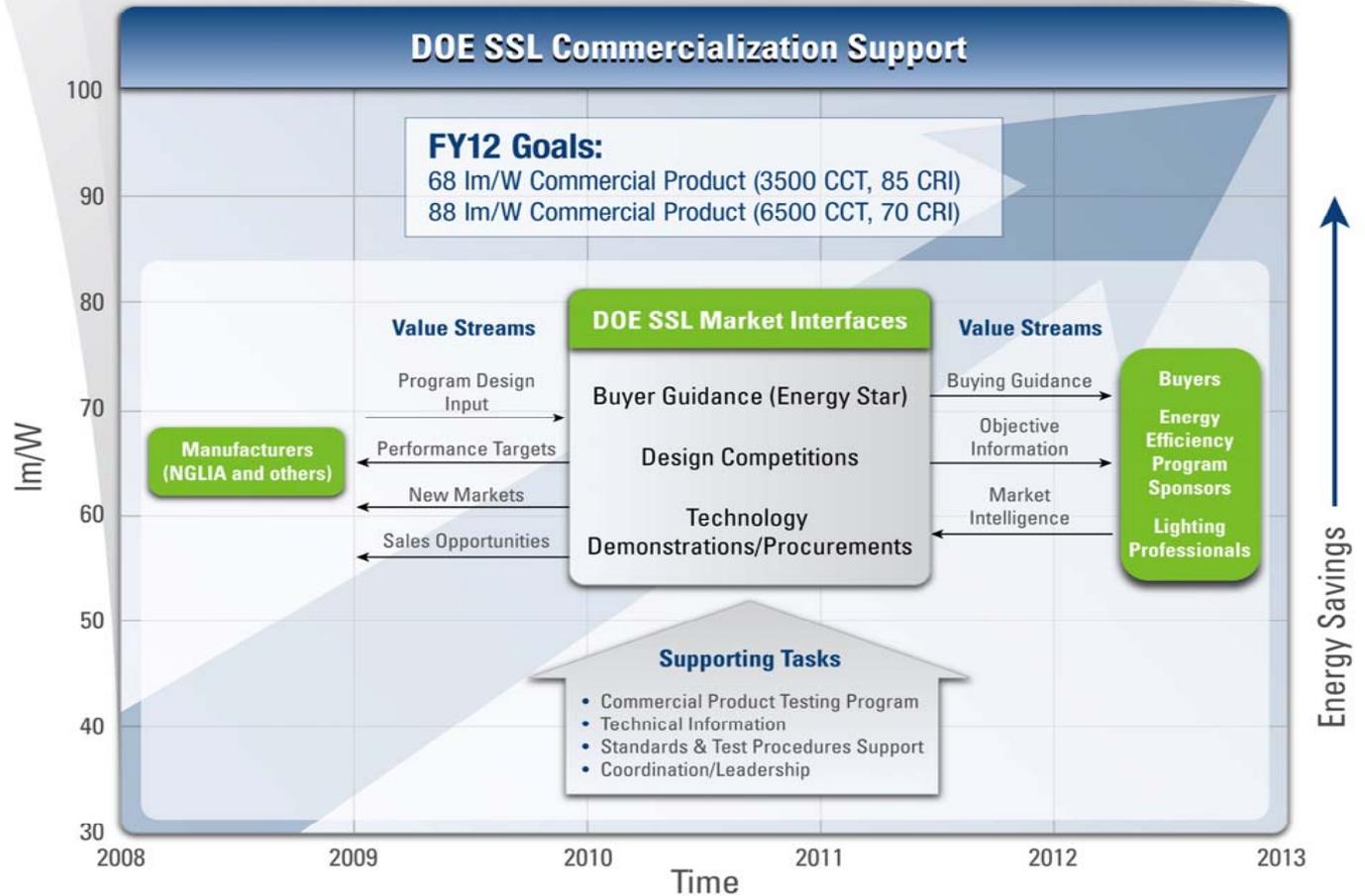
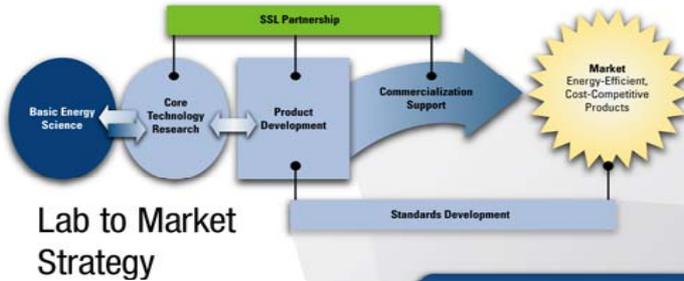


- DOE workshops in March and October 06
- In process:
 - Photometric Measurement (LM-79)
 - Lumen Depreciation (LM-80)
 - Chromaticity (ANSI C78.377A)
 - Electrical performance (ANSI C78.XX3)
 - SSL-LED power supply (ANSI C82.XX1)
 - Definitions/nomenclature (IESNA RP-16)
- New standards before end of 07



7) Coordination and Leadership

- Federal government is largest U.S. energy consumer
 - Working with FEMP to identify opportunities for early SSL applications
- Organize workshops, joint projects for key partners, including:
 - Efficiency organizations, utilities
 - Lighting industry professionals
 - Fixture manufacturers





Key Issues to be Considered in Project Development

1. Early, low-performing products can cause long-term market damage
2. High costs
3. Low color quality, high CCT
4. Incomplete standards and test procedures
5. Lead to profligate use of lighting
6. Quick obsolescence
7. Retrofit products
8. Commercial vs. residential emphasis
9. Appropriate near-term lighting applications



DOE Solid-State Lighting Website

- Current information on SSL program, progress, and events
- SSL publications: roadmaps, reports, technical fact sheets
- Solicitations
- Register for ongoing SSL UPDATES at: www.netl.doe.gov/ssl

The screenshot shows a web browser window titled "Solid-State Lighting" with the URL <http://www.netl.doe.gov/ssl/index.html>. The page header includes the U.S. Department of Energy logo and the text "Energy Efficiency and Renewable Energy" with the tagline "Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable." The main navigation bar features "Building Technologies Program" and "Solid-State Lighting" with a "Cleaner environment" tag. The left sidebar contains a "DOE SSL Strategy" menu with items like "R&D Project Portfolio", "Market-Based Programs", "ENERGY STAR", "Commercial Product Testing Program", "Standards Development", "Technical Information Network", "Technology Demonstrations", "Design Competitions", "Using LEDs for General Illumination", "LED Basics", "LED Application Series", "LED Measurement Series", "Funding Opportunities", "Publications", "Related Articles", and "Home". The main content area is divided into three columns. The first column, "DOE Solid-State Lighting Portfolio", contains introductory text about accelerating advances in solid-state lighting and a note that no other lighting technology offers the same potential to save energy and enhance building environments. The second column, "R & D SPOTLIGHT", features three items: "Record efficacy in white OLED", "LED record efficacy and brightness", and "Record EQE in blue OLED device". The third column, "COMMERCIALIZATION SUPPORT SPOTLIGHT", features three items: "DOE releases draft ENERGY STAR requirements", "DOE and IESNA sign MOU", and "NGLIA collaborates on draft ENERGY STAR criteria, WYPP updates". A fourth item, "LIGHTING tomorrow 2007 Light for Tomorrow Competition", is also listed. A right-hand "UPDATES" section, with a "Register for Updates" button, lists several recent events and funding opportunities, including a "Webcast: DOE Five-Year SSL Commercialization Support Plan July 2, 2007", "Voices for SSL Efficiency: DOE SSL Workshop July 16-17, 2007", "Funding Opportunity Released for Product Development (Round 4)", "DOE Awards Five SBIR Phase 1 Grants for SSL", "Funding Opportunity Released for Core Technology Research (Round 4)", "Research Call Released for Core Technology (Round 4) (MODIFIED) (PDF 159 KB)", "DOE Announces Selections for SSL Core Technology and Product Development (Round 3)", "DOE Releases Updated Multi-Year Program Plan (PDF 2 MB)", "Invitation to Participate in DOE SSL Demonstrations (CLOSED)", "Voices for SSL Efficiency: DOE SSL Workshop April 23-24, 2007", and "Archives". The footer includes links for "Webmaster", "Security & Privacy", "Building Technologies Program Home", and "EERE Home", along with the text "U.S. Department of Energy".



***“Even if you’re on the right track
you’ll get run over
if you just sit there.”***

Will Rogers

