



ENERGY STAR[®] SSL

Getting Ready for September 30th

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U.S. Department of Energy

June 26, 2008

Scope



- Excludes OLEDs... for now!
- Limits coverage to LED systems for general illumination only
- Both commercial and residential
- Luminaire efficacy key metric
- Establishes 2-category specification:
 - Category A: prescriptive specifications for niche category lighting applications (near-term)
 - Category B: performance specification for all applications (long-term)

Transitional Two-Category Approach



- Approach recognizes rapidly changing technology
- Allows early participation of limited range of SSL products taking advantage of inherent LED directionality (Category A)
- At some point (~3 years), Category A will be dropped entirely; Category B then becomes basis of criteria

Lighting industry is learning the unique issues of applying SSL to general illumination. Going slow allows industry and DOE to learn, and adjust

Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market



- Valuable lessons
 - Be aggressive about dealing with technology failures that affect main benefit claims
 - Know and admit technology limitations
 - Don't introduce inferior products; first impressions are long lasting
 - Manufacturers and energy-efficiency groups should coordinate to establish minimum performance requirements
- Use to avoid "CFL Part II"
- Apply to SSL commercialization path
- Available at:

**Compact Fluorescent Lighting in America:
Lessons Learned on the Way to Market**

Prepared by
Pacific Northwest National Laboratory

for
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies Program

June 2006

<http://www.netl.doe.gov/ssl/publications/>



DOE's Commitment to ENERGY STAR



- Protect the ENERGY STAR brand and SSL technology by assuring end-user satisfaction
- Use industry vetted standards and test procedures developed by the IESNA, ANSI, UL, etc.
- Follow mandatory stakeholder engagement
- Observe the EPA Act guidelines for effective date 270 days after final document
- Quality assurance (QA) testing

2005 Energy Policy Act

Section - 131 ENERGY STAR



“DUTIES.—The Administrator and the Secretary shall—

... (5) solicit comments from interested parties prior to establishing or revising an Energy Star product category...

(6) on adoption of a new or revised product category, specification, or criterion, provide reasonable notice to interested parties of any changes (including effective dates)... along with—

(A) an explanation of the changes; and (B) as appropriate, responses to comments submitted; ...

(7) provide appropriate lead time (which shall be 270 days, unless the Agency or Department specifies otherwise) prior to the applicable effective date for a new or a significant revision to a product category, specification, or criterion, ...”

Activities to Date and Upcoming Events



- 1st Draft released December 20, 2006
- Stakeholder meeting February 8, 2007
- 2nd Draft released April 9, 2007
- Final Criteria released September 12, 2007
- Manufacturer Stakeholder meeting May 15, 2008
- DOE SSL Market Introduction Workshop July 9-11, 2008 in Portland, OR
- Effective date set for September 30, 2008

Future Strategy



- Near-term: add additional Category A applications
- Maintain pace with technology by periodic increases in efficacy
- Steadily add applications:
 - as the technology and infrastructure evolves
 - as industry standards are developed
 - as products are proven through DOE's CALiPER program



ENERGY STAR[®] Criteria for Solid State Lighting

Jeff McCullough, LC

Pacific Northwest National Laboratory

Understanding Terminology

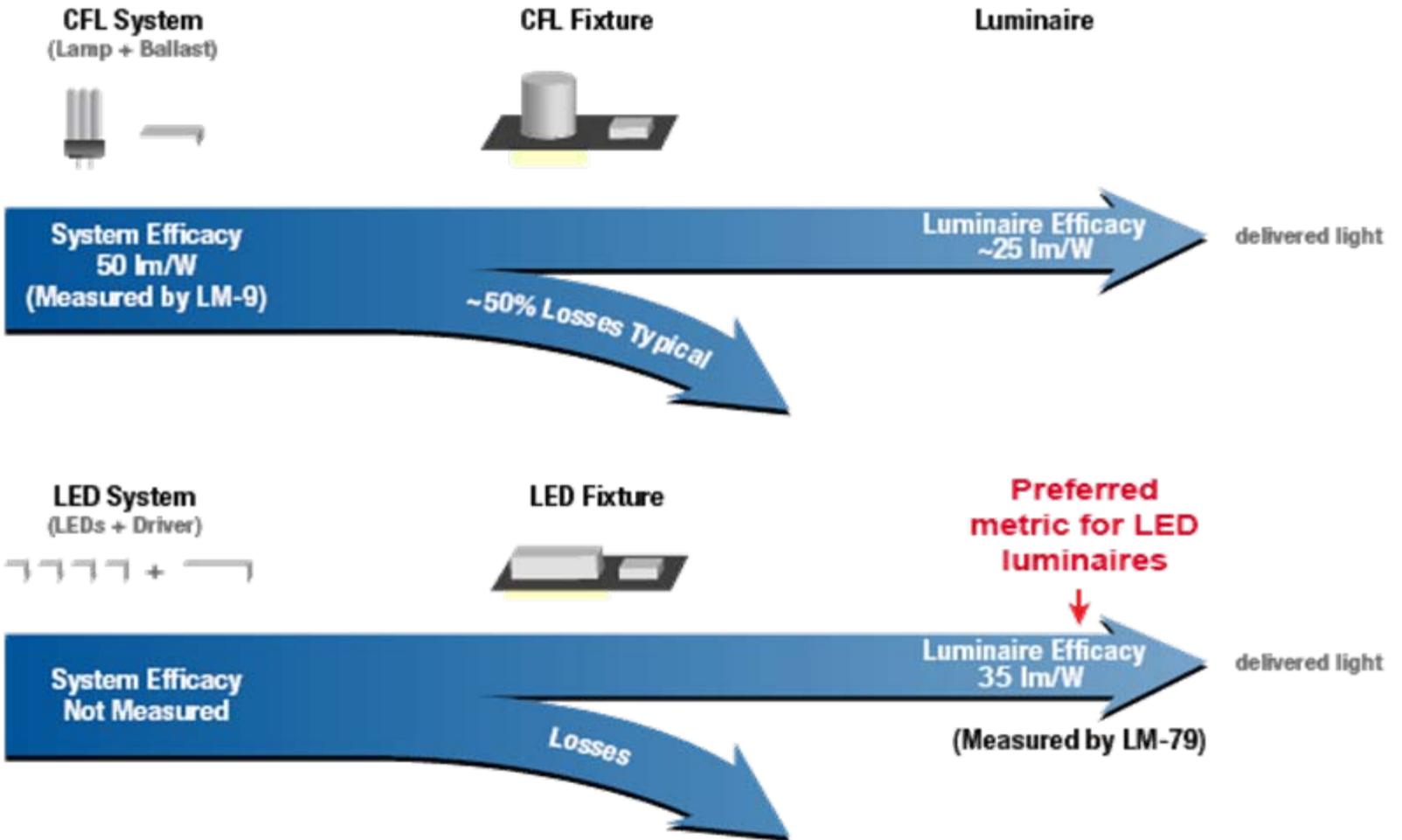


$$\text{Lamp Efficacy} = \frac{\text{Rated Lamp Lumens}}{\text{Lamp Input Power}}$$

$$\text{System Efficacy}_{\text{fluor}} = \frac{\text{Rated Lamp Lumens} \times \text{BF}}{\text{Ballast Input Power}}$$

$$\text{Luminaire Efficacy} = \frac{\text{Luminaire Light Output}}{\text{Ballast/Driver Input Power}}$$

System Efficacy Vs. Luminaire Efficacy (Recessed Downlights Example)



- **ANSI C78.377-2008** *Specification for Chromaticity of SSL Products*
- **IESNA LM-79-2008** *Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products*
- **IESNA LM-80-XX** *Approved Method for Measuring Lumen Maintenance of LED Light Sources*
- **IESNA RP-16-2005** (amendment) *Nomenclature and Definitions for Illuminating Engineering*
- **ANSI C82.XX1** *Power Supplies*
- **UL “Outline of Investigation”**

Overall Requirements

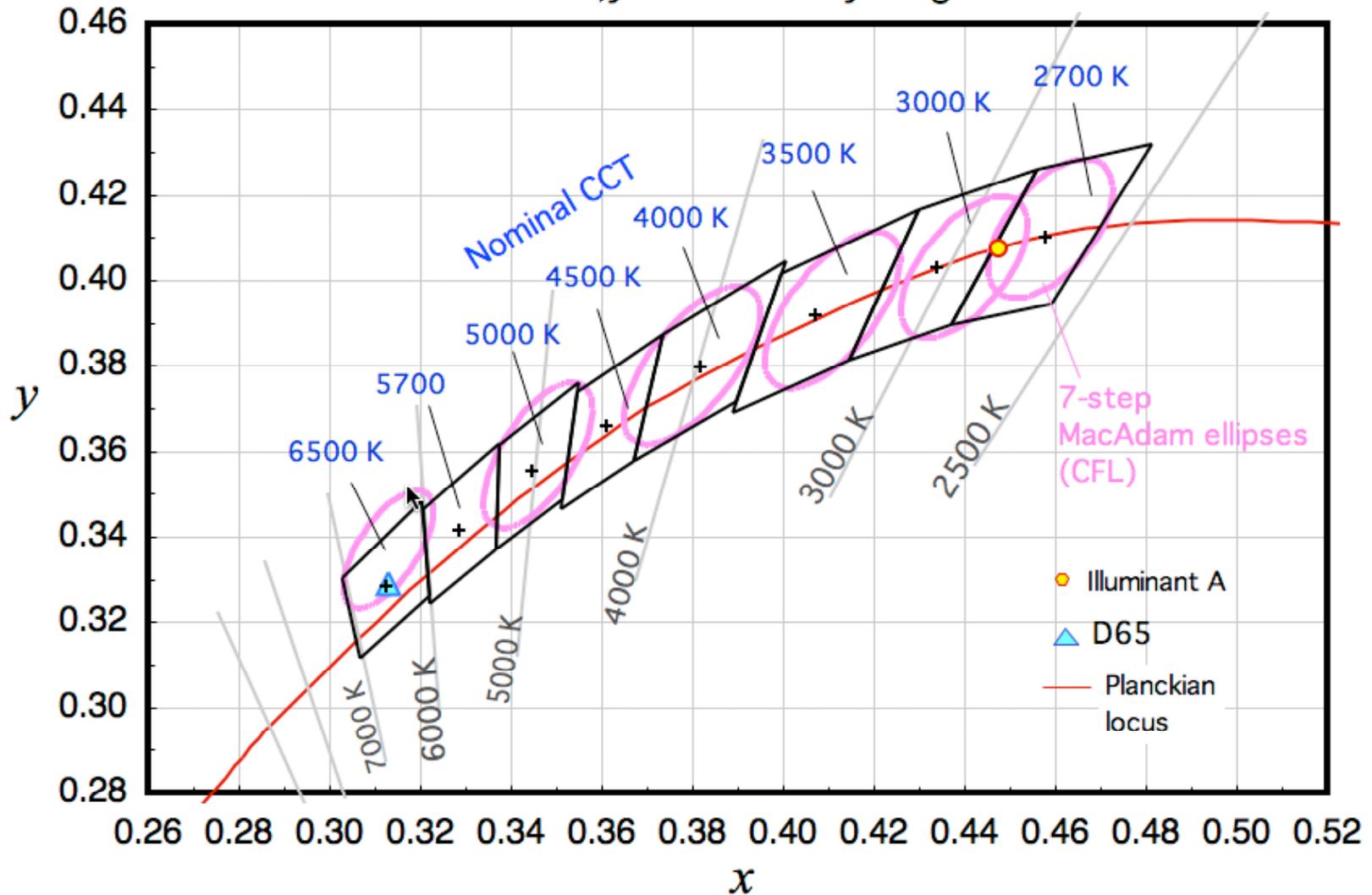


- Luminaire
 - CCTs: 8 nominal CCTs
 - Color Spatial Uniformity: 4-step
 - Color Maintenance: 7-step
 - CRI: ≥ 75 for indoor, silent on outdoor
 - Off-state Power prohibited
 - Exception for integral controls, limited to 0.5W
 - 3 Year Warranty
 - Thermal Management

ANSI C78.377-2008



CIE 1931 x,y Chromaticity Diagram



Overall Requirements (cont.)



- **Modules/Arrays**
 - Lumen depreciation (L_{70})
 - Residential Indoor $\geq 25,000$ hours
 - Residential Outdoor and all Commercial $\geq 35,000$ hours
- **Residential Outdoor Luminaires**
 - Attached to buildings and > 13 watts requires photo-control
- **Power Supplies**
 - Power Factor
 - ≥ 0.7 Residential ≥ 0.9 Commercial
 - ≥ 120 Hz Output Operating Frequency

Assumptions for Establishing Luminaire Efficacy

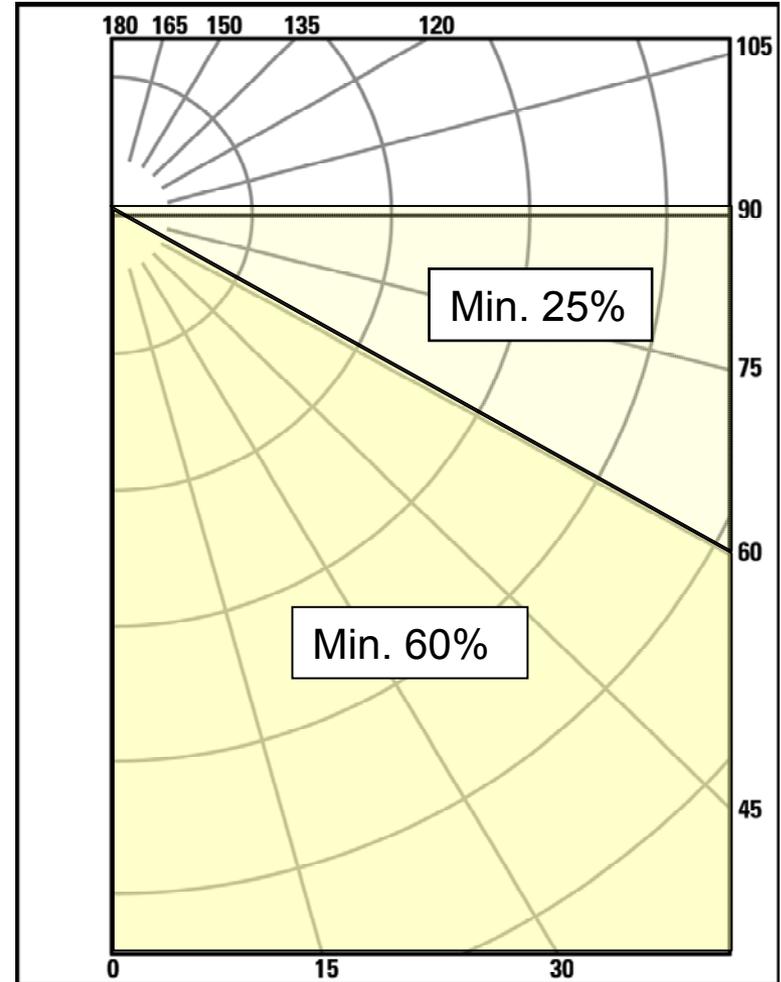


Near-term Application	CFL System Efficacy	Typical Fixture Efficiency	Calculated Luminaire Efficacy
Under-cabinet Kitchen	58.8	40%	24
Under-cabinet Shelf-mounted Task	58.8	50%	29
Portable Task	58.8	50%	29
Recessed Downlight (residential)	58.8	60%	35
Recessed Downlight (commercial)	58.8	60%	35
Outdoor Wall-mounted Porch	58.8	40%	24
Outdoor Step	50	40%	20
Outdoor Pathway	50	50%	25

Under-cabinet Kitchen



- **Minimum Light Output**
 - 125 lumens per lineal foot
- **Zonal Lumen Density**
 - Min. 60% in 0-60° zone
 - Min. 25% in 60-90° zone
- **Luminaire Efficacy**
 - ≥ 24 lm/W
- **CCTs limited to:**
 - 2700 - 3500K



Category A: Under-cabinet Lighting



Philips SSL Solutions



Osram

Category B: Efficacy Based Performance



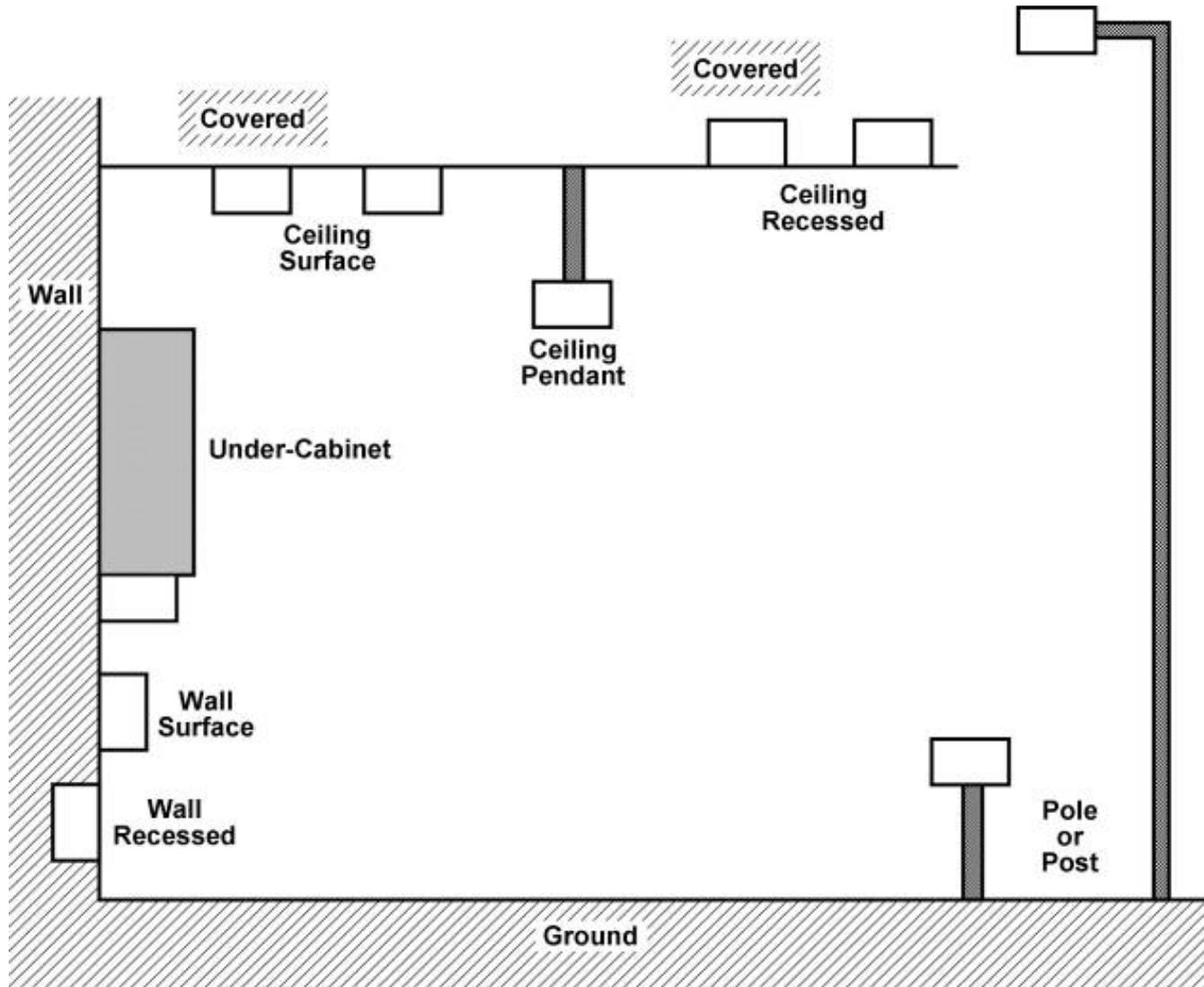
- Aggressive efficacy requirement: 70 lm/W
- Simpler; no total flux or zonal lumen requirements
- Allows for non-directional/decorative lighting applications
- Manufacturers able to qualify under Category B approx. three (3) years after the effective date
- Serves as future target for manufacturers

In Situ Testing Requirement



- Lumen depreciation (Life) determined by in situ temperature measurements of:
 - Module or Array
 - Power Supply/Driver
- Testing may be conducted at the same time as UL 1598.
- Tests conducted by independent third-party laboratories

UL 1598 Environments



Adapted from UL1598

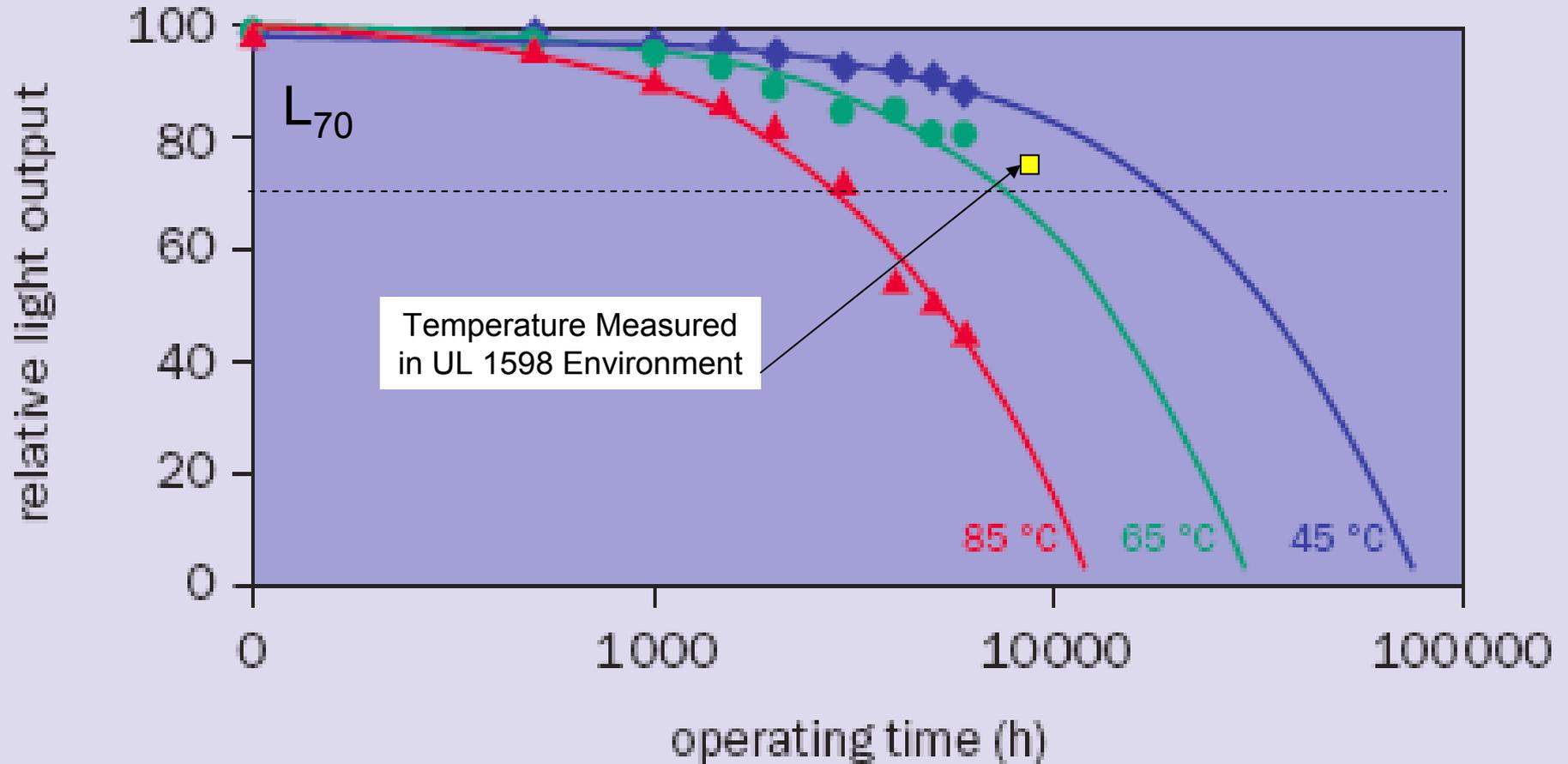
Temperature Measurement Point (TMP)



- Manufacturer designated TMP correlating to LM-80 test report or power supply warranty
 - Module/Array
 - Solder Joint Temperature T_s
 - Case Temperature T_c
 - Board Temperature T_b
 - Power Supply
 - Case Temperature T_c
 - Could also be T_b for integral Power



Sample LM-80 Test Report



Lumen Depreciation “Passing” Criteria



A luminaire passes the L_{70} threshold ($\geq 25,000$ hours for indoor residential and $\geq 35,000$ for all others) ...

- if the in situ measured drive current is the same or lower

AND

- if the in situ measured TMP for the device/module/array is the same or lower

... than the LM-80 test report provided for the device/module/array.

Quality Assurance Testing



- Products selected both on a random basis and through a product nomination process.
- (3) samples of each luminaire purchased through normal market channels.
- Products tested for:
 - Total Luminous Flux
 - Luminaire Efficacy
 - Correlated Color Temperature
 - Color Rendering Index
 - Steady State Module/Array Temperature
 - Maximum Power Supply Case/TMP Temperature

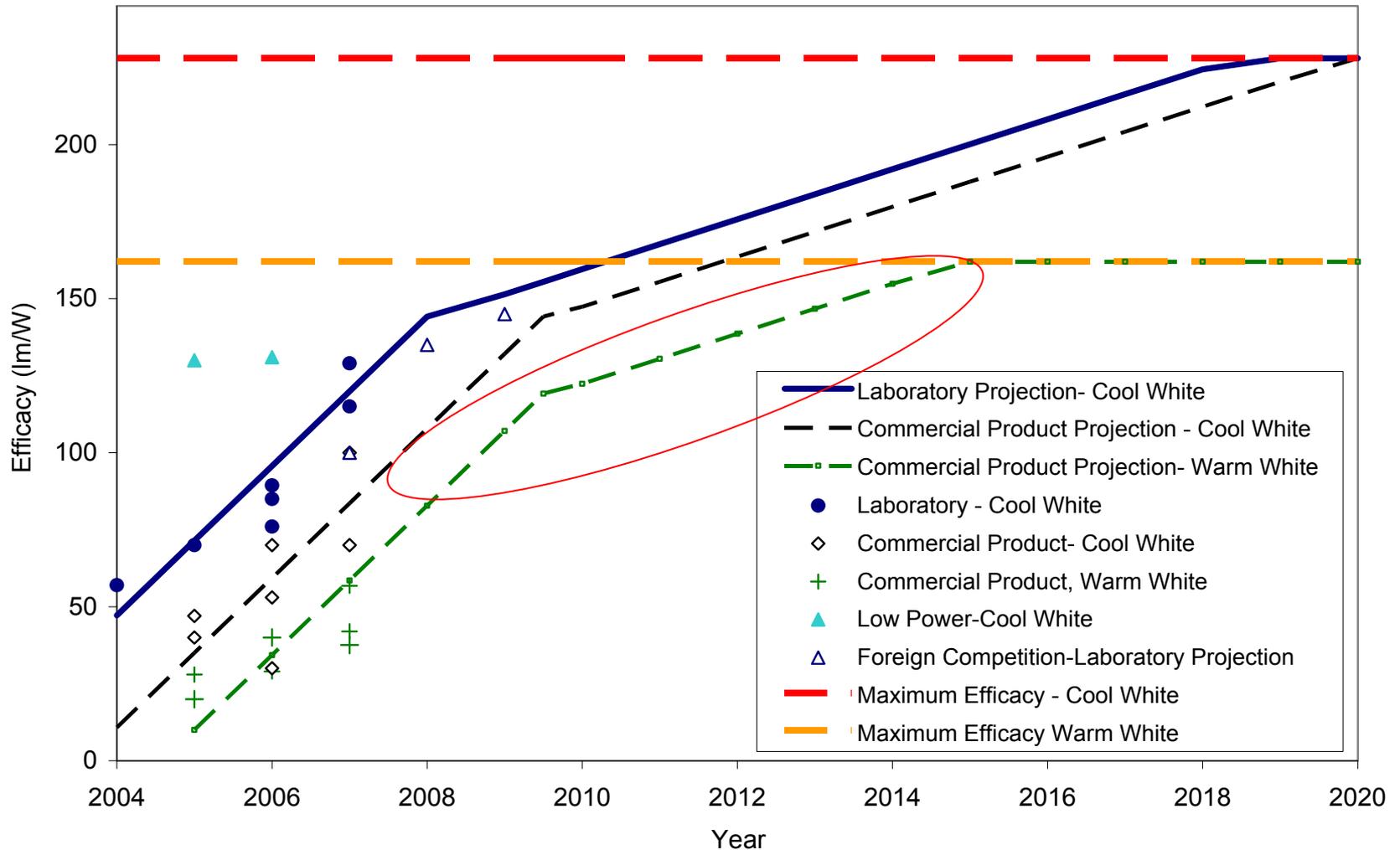
Future Strategy



- DOE has announced that it is considering adding the following applications to Category A:
 - Street and area lighting
 - Parking garage lighting
 - Cove lighting
 - Ceiling fan light kits
 - Replacement lamp applications
 - Display and accent lighting
 - Wall-wash applications
- Maintain pace with technology
 - Converging Ratchet

White Light SSL Efficacy Projections

Mar. 2008 Targets



LED Luminaire Performance Projections



Metric	2007	2010	2012	2015
Device Efficacy-Commercial Cool White (lm/W, 25 degrees C)	84	147	164	188
Efficacy-Commercial Warm White (lm/W)	59	122	139	163
Thermal Efficiency	85%	89%	91%	95%
Efficiency of Driver	85%	89%	91%	95%
Efficiency of Fixture	77%	84%	88%	95%
Resultant luminaire efficiency	56%	66%	73%	86%
Luminaire Efficacy-Commercial Cool White (lm/W)	47	97	121	161
Luminaire Efficacy-Commercial Warm White (lm/W)	33	80	101	140

New, improved products appearing regularly



Beta Lighting



LLF



Progress



Finelite



Planned Efficacy Ratchet



- Technology is changing too fast to maintain existing efficacy requirements for extended period
- Given rapid observed and projected efficacy improvements, DOE plans to adopt a schedule of future min. efficacy increases

Effect of Ratchet on Qualified Products



- Already qualified products would not have to be retested/re-qualified for 1 year after ratchet increase
- But, **all** qualified products required to re-qualify at least once every 2 years
- Products qualified under different efficacy requirements are all ENERGY STAR; no differentiation; no special designation



Launching the ENERGY STAR[®] SSL Program

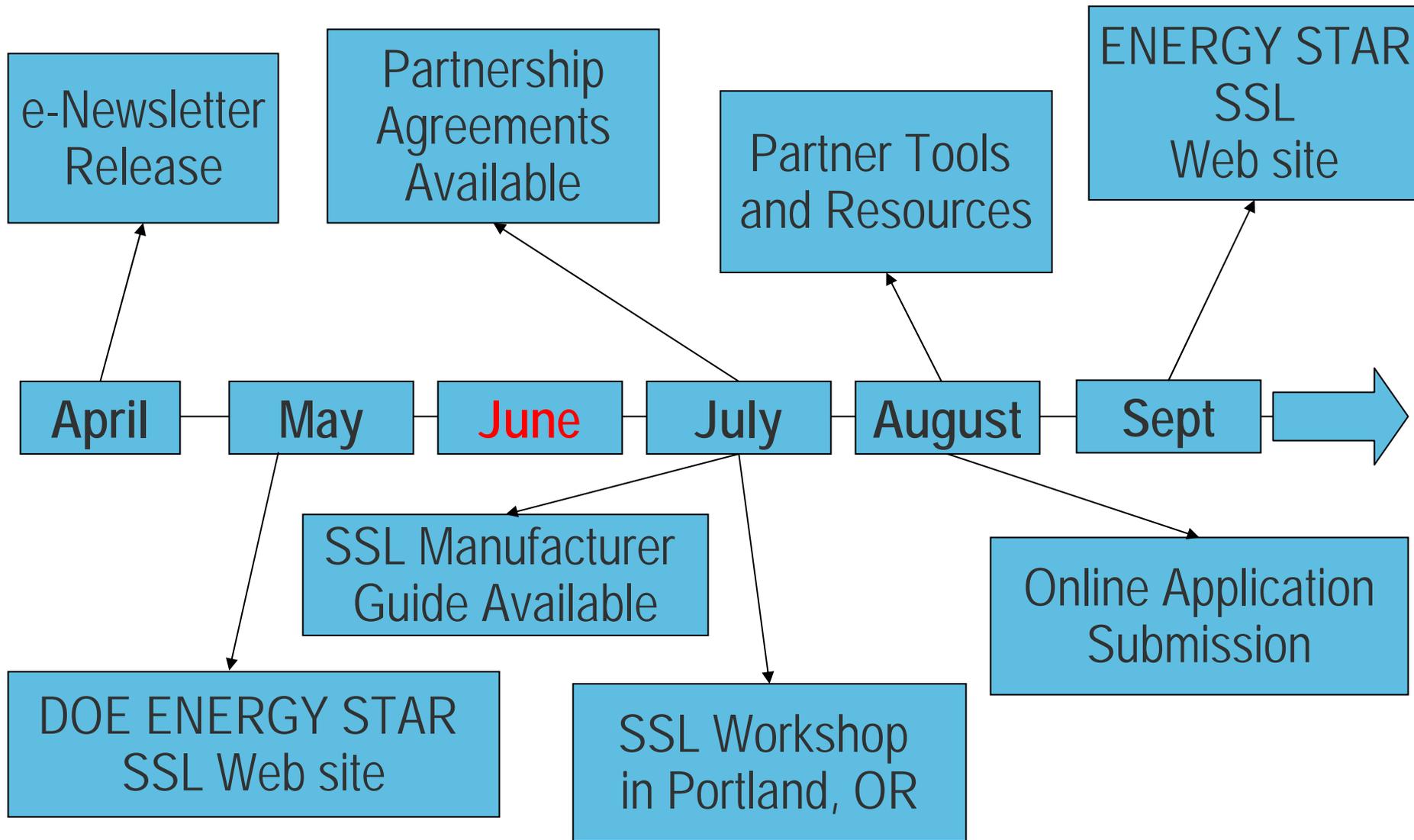
Marci Sanders
D&R International

Overview



1. Pre-Launch Timeline
2. Product Qualification Process
3. Partner Outreach Activities
4. Consumer Outreach Activities

Pre-Launch Timeline



Product Qualification Steps



- Becoming an ENERGY STAR Partner
- Manufacturer Guidelines
- Online Process for Qualification Submission

Step 1: Becoming a Partner



- Partnership Agreement
 - Available in July
- Complete and Sign a Partnership Agreement
 - Voluntary, non-binding document
- My ENERGY STAR Account (MESA) information will be sent to you

Step 2: Manufacturers Guide



The SSL Manufacturers Guide will answer your questions regarding qualification process:

- Outline the Process for Submitting Products
- Submission forms
- Checklist of Data Needs
- Sample Size
- Approved Margins of Error
- Guide available in July
 - Notice will be sent via ENERGY STAR SSL e-mail
 - Posted on DOE SSL website:
www.netl.doe.gov/ssl

Step 3: Online Process for Application Submission



- Applications will be submitted on-line by manufacturers
- Upload test reports and packaging to Web site
- Instant feedback will be provided
- Available in August



Solid State Lighting *Product Submission Web Tool*

DOE has finalized a new ENERGY STAR specification for solid state lighting luminaires. The criteria will go into effect September 30, 2008.

The ENERGY STAR Program Requirements for Solid State Lighting (SSL) Luminaires are intended for general illumination. SSL general illumination devices were not previously covered by any ENERGY STAR product category, although there are other product categories using light emitting diodes (LEDs) for non-illumination purposes, including indication and decoration.

Email: Password:

[Forgotten Password?](#) | [Register \(optional\)](#)

The Energy Star Solid State Lighting Product Submission Web Tool was created to streamline the product submission process ...

Contact: [Technical Support](#)
[Security & Privacy](#)

Partner Outreach Activities



- Announce progress and share information via e-newsletter
- Web site information on program
 - DOE-SSL site at www.netl.doe.gov/ssl/energy_star.html
 - Will transfer to energystar.gov when program launches
- Forums for Stakeholders:
 - Stakeholder Workshop in Washington DC on May 15
 - AESP Brownbag on June 5
 - DOE SSL Workshop in Portland on July 9-11

Consumer Outreach Activities



- Simple and Clear Messaging
- Web Content
- Tools and Resources

Simple and Clear Messaging



- ENERGY STAR messaging:
 - Initial Targets:
 - Residential: Early adopters attracted by new technology
 - Commercial: Lighting designers
 - Primary Message:
 - Residential Indoor: Superior light quality
 - Residential Outdoor: Durability
 - Commercial: Design elements
 - Secondary Messages: Long life; energy savings
- CFLs are not the enemy – there is room for both

Web Content



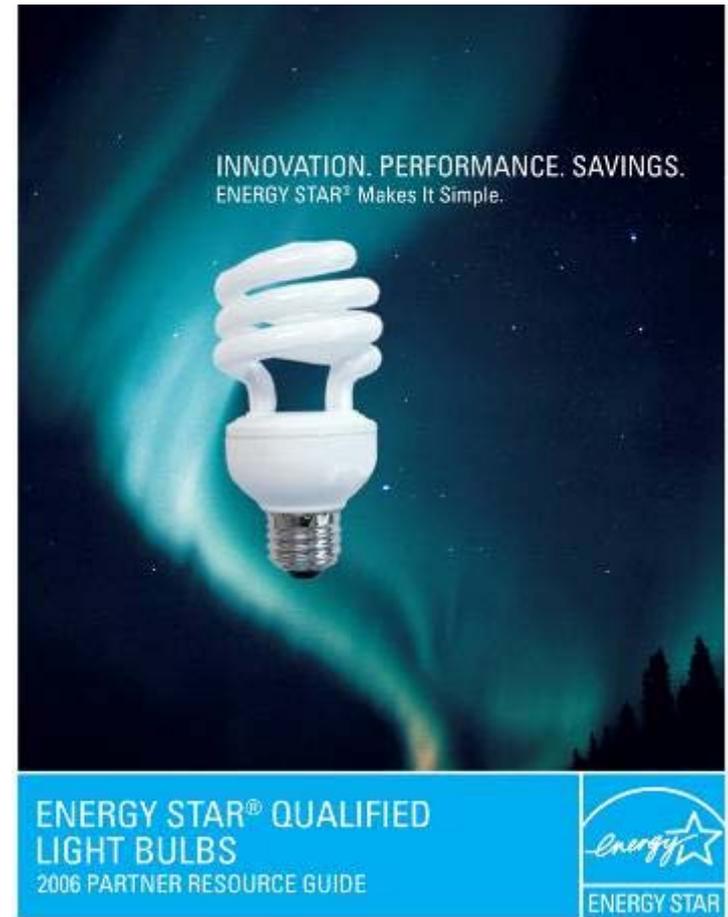
- Qualified Product List and Locator (*not before effective date of Sept. 30*)
- Rebate Locator
- Savings Calculator
- FAQs
- Consumer Education Tools

Tools and Resources in Development



ENERGY STAR provides a number of tools and resources for partners to use. They can be customized to meet your specific needs.

- Partner Resource Guide
- Info Graphics
- SSL Facts and Figures
- Frequently Asked Questions (FAQs)
- Mini Business Case
- Product Profiles, Market Profiles, Product Snapshots
- Media Outreach and Support
- Sales Data



Sample Partner Brochures



More than Just a Bright Idea.

ENERGY STAR Qualified Light Bulbs
An Energy-Wise Choice

Innovative Performance. Savings.

U.S. Department of Energy
Energy Efficiency
ENERGY STAR

For more information visit
www.energystar.gov

For all energy efficiency and conservation
products visit www.energystar.gov

Save with ENERGY STAR Qualified Light Bulbs... www.energystar.gov/lightbulbs

Save Time and Money ENERGY STAR qualified light bulbs last 10-15 times longer than incandescent bulbs.

Save Energy and Money Just ENERGY STAR qualified light bulbs can save about \$200 a year for the home.

Stay Cool ENERGY STAR light bulbs give off less heat, keeping you cooler and reducing the need for air conditioning and fans to keep the house shady.

Help the Environment By using less energy, ENERGY STAR qualified light bulbs help reduce air pollution and greenhouse gas emissions from power plants.

Switch & Save
Changing to ENERGY STAR qualified Compact Fluorescent lamps (CFLs) for one of the brightest ways to help protect your wallet. However, savings do vary. CFLs may require you to use the energy. CFLs may work best in spots for applications like the ones in the light to save more than 75% in the long-term future.

Choosing the Lamp
Compact fluorescent light bulbs contain a small amount of mercury, so they should be disposed of properly. Labels and use local recycling centers for recycling information on recycling or disposing of CFLs properly.

CFLs use innovative technology that is **4 TIMES MORE EFFICIENT** than regular bulbs!

ENERGY STAR qualified compact fluorescent light bulbs (CFLs) are a **GREAT INVESTMENT** for your home.

- They can **LAST SEVEN YEARS**—compared to 11 months for a regular incandescent bulb.*
- Replace five incandescent bulbs with CFLs and **SAVE MORE THAN \$150** over the lifetime of the bulbs!

To get the greatest benefits install CFLs wherever you leave lights on the most, such as the family/living room, kitchen, dining room, bedroom, laundry room, and porch.

* Assumes 3 hours of use per day.

ENERGY STAR
The National Symbol for Energy Efficiency.
Bringing Value, Comfort, and Savings to Your Home!

LEARN MORE AT www.energystar.gov

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www.energystar.gov
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Compact Fluorescent Light Bulbs (CFLs)

Sample Info Graphics



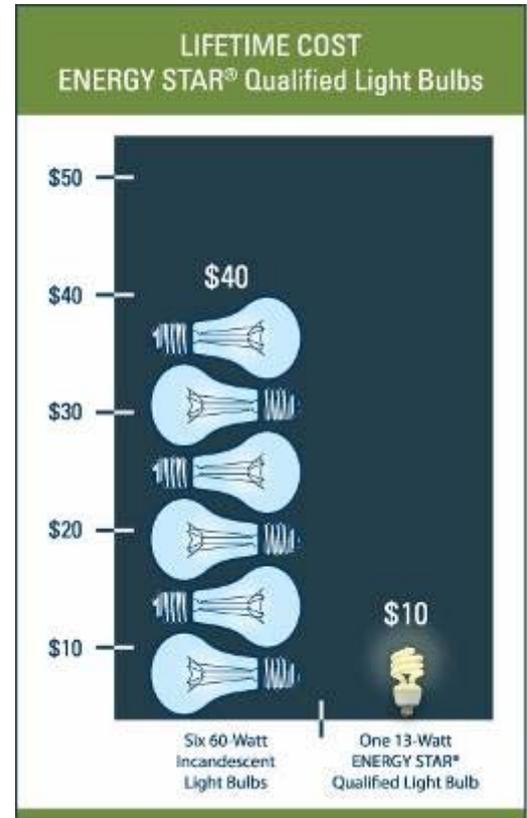
HOW TO CHOOSE THE RIGHT ENERGY STAR® QUALIFIED LIGHT BULB

	INCANDESCENT	THREAT	ENERGY	THREAT	THREAT	THREAT	THREAT	THREAT	THREAT
✓	✓		✓		✓			✓	
✓	✓	✓		✓				✓	
✓		✓		✓				✓	
✓	✓		✓					✓	
✓					✓			✓	
✓						✓		✓	
✓							✓	✓	
✓									✓

AVOID EARLY BURN OUT

- Only bulbs marked "dimable" or "dimmable" will work as dimmers in the home.
- Most dimmers and levels are not designed to work with CFLs.

LEARN MORE AT energystar.gov



Sample Web Tools



The image shows a screenshot of an interactive web tool for selecting Compact Fluorescent Lamps (CFLs). The interface is set against a light blue background. On the left, a 3D-rendered living room scene is shown with various light fixtures. A blue star icon is placed over a lamp in the foreground. Below the scene is a button that says "Click Here to Turn All Fixtures On".

On the right side, there is a panel titled "Create Your Mood!". It features four light bulb icons with labels: "Daylight COOLER", "Bright White NEUTRAL", "Soft White WARMER", and "Dimmer WARM". Below this panel is a text box titled "Spiral Bulbs" with the following text:

Spiral Bulbs
If these spiral-shaped light bulbs look familiar it's because they're the most popular type of Compact Fluorescent Lamp (CFL). Spiral CFLs create the same amount of light as traditional incandescent bulbs, but use less energy.

Many traditional bulbs around your home (from 60w to 150w) can be replaced with spirals. There are spirals for dimmers and three-way.

At the bottom of the interface is a horizontal row of nine light bulb icons, each with a label below it: "Spiral", "A-Shape", "Globe", "Tubed", "Candle", "Indoor", "Outdoor", "3-Way", and "Dimmable".

For More Information



D&R Program Contact:

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Phone: 301-588-9387

- Website: www.netl.doe.gov/ssl/energy_star.html
- Send emails to ssl@energystar.gov

Key Contacts



- Website: www.netl.doe.gov/ssl/energy_star.html
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 - Email: jeff.mccullough@pnl.gov
- Derek Greenauer
 - Email: dgreenauer@drintl.com

SSL v1.0 - RLF v4.2 Conflict



- DOE acknowledges ENERGY STAR stakeholder concerns and is working to resolve the issue as quickly as possible
- Significant conflict/overlap exists between DOE's v1.0 and EPA's v4.2
 - They are not complementary nor was DOE consulted
- DOE recognizes there can only be one ENERGY STAR criteria for SSL

DOE Commitment



- Maintain open process with stakeholder involvement
- Continue to focus on product quality
 - Using standards and test procedures recognized by industry standards organizations (e.g., IESNA, ANSI, CIE, etc.)
- Moving forward with the SSL criteria and program launch
- All questions from today's webcast will be answered!



Questions?