ENERGY STAR® Luminaires Specification

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March 9, 2011

Agenda

- ENERGY STAR Luminaires program overview
- Directional/Non-Directional categories
- Certified Lighting Subcomponent Database
- LED light engines
- IES LM-82 and TM-21
- Steps to participate
- Timeline for specification implementation
- Questions

ENERGY STAR Luminaires Program Overview

Residential Light Fixtures V4.2 (RLF)

Solid State Lighting Luminaires V1.3 (SSL)

ENERGY STAR Luminaires V1.0

- finalized February 16, 2011
- effective October 1, 2011

- In Spring of 2010, EPA began the development of a technology-neutral ENERGY STAR specification for light fixtures to replace the existing two specifications.

- On February 16th, 2011, EPA released the new Luminaires specification.

ENERGY STAR Luminaires: Program Overview

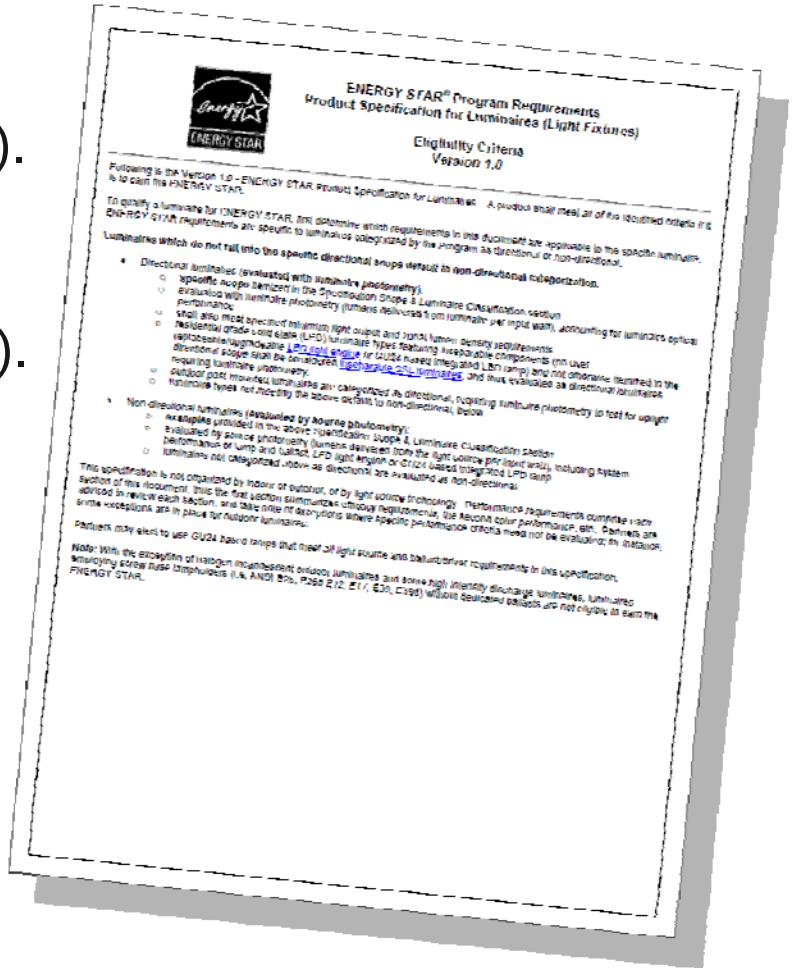
- The promotion of individual technologies confuses consumers and confuses the promotion of energy-efficient lighting.
- New specifications are technology-neutral for luminous efficacy, color temperature, and color rendering.
- Technology neutrality provides an objective means to increase efficacy levels.

ENERGY STAR Luminaires: Specification Integration

- Allows technologies to compete in the market place:
  - LEDs luminaires should be able to perform as well as fluorescent luminaires.
  - Regardless of technology, all ENERGY STAR qualified luminaires should be reliable, high-quality replacements for incandescent.
  - Simplest, most effective message: **look for the ENERGY STAR.**

ENERGY STAR Luminaires V1.0

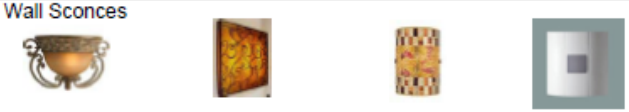
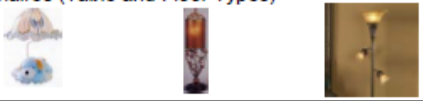
- Directional luminaires and inseparable luminaires will be tested using luminaire photometry (already required in SSL spec).
- Non-directional products with replaceable light sources will be tested using source photometry (already required in RLF spec).
- Provisions for high intensity discharge luminaires (HID) were added.
- Halogen luminaires have photo/motion sensor requirements.
- Efficacy levels were raised for most products.



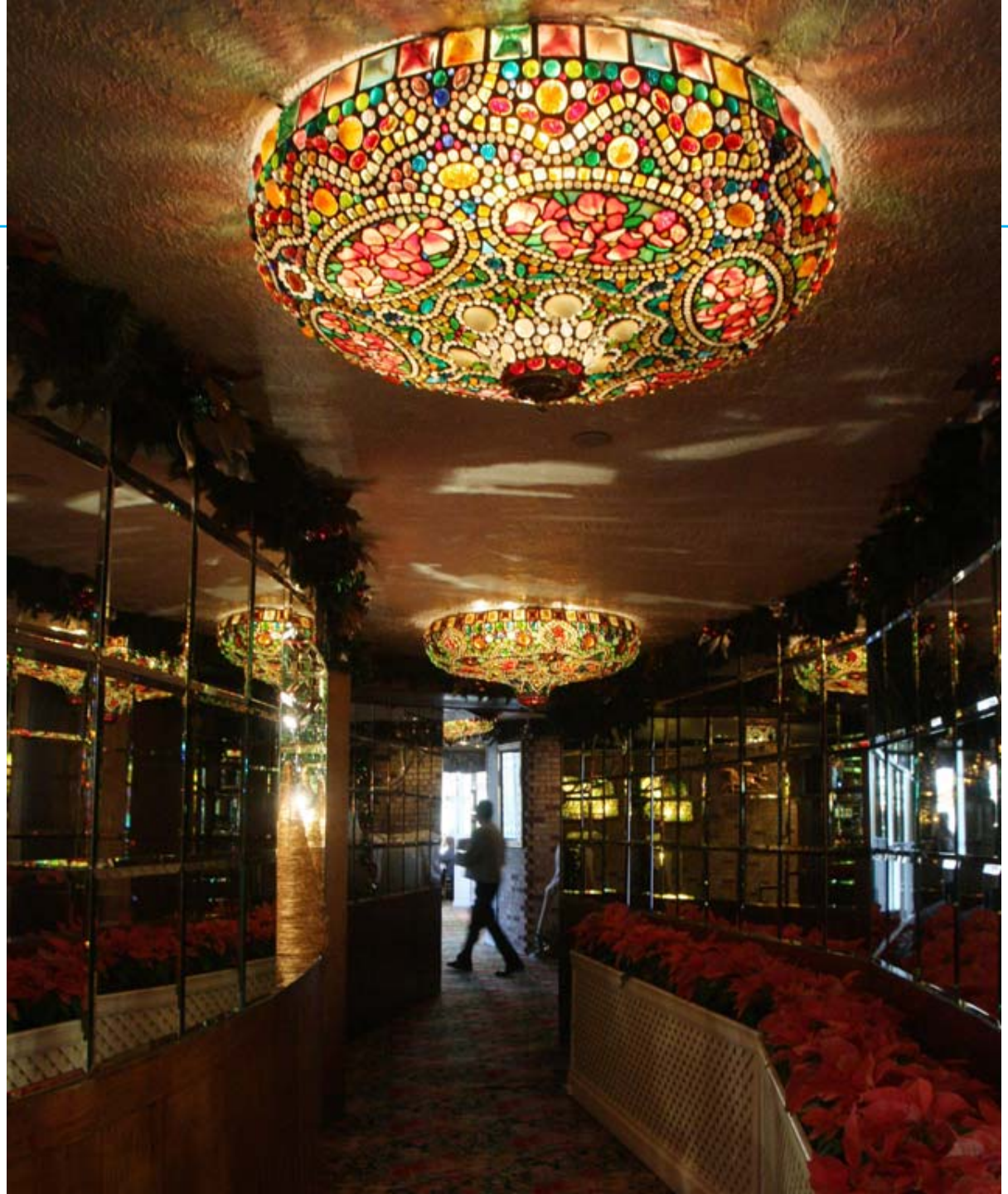
ENERGY STAR® Program Requirements
Product Specification for Luminaires (Light Fixtures)

Eligibility Criteria
Version 1.0

NEMA / ALA LSD 51-2009

Luminaire Description or Style	Type
Chandeliers 	B
Recessed Down-Lights 	F
Wall Sconces 	D
Surface Mount 	B
Hanging Pendants 	B
Portable Luminaires (Table and Floor Types) 	B
Track 	F
Task 	F
Accent 	D

© Copyright 2009 by the National Electrical Manufacturers Association.



Directional/Non-Directional Categories

- NEMA/ALA Roundtable on March 4, 2010:
  - Developed consensus:
    - Visible source: test with luminaire photometry
    - Obscured source: test with source photometry

- Luminaires V1.0 spec adopts directional & non-directional categories.
    - Directional: test with luminaire photometry
    - Non-directional: test with source photometry

Directional Luminaires

- Designed to put light on a specific surface or area.
- Evaluated with luminaire photometry: delivered lumens per input watt.
- Tested per IES LM-79 (SSL); LM-10 or LM-41 (fluorescent) and LM-31 or LM-46 (HID).
- Includes zonal lumen density (intensity distribution) requirements.
- Includes minimum light output requirements.
- Specific scope detailed in spec, includes limited number of commercial lighting products.

Luminaires not classified as directional default to non-directional classification.

Luminaire Photometry

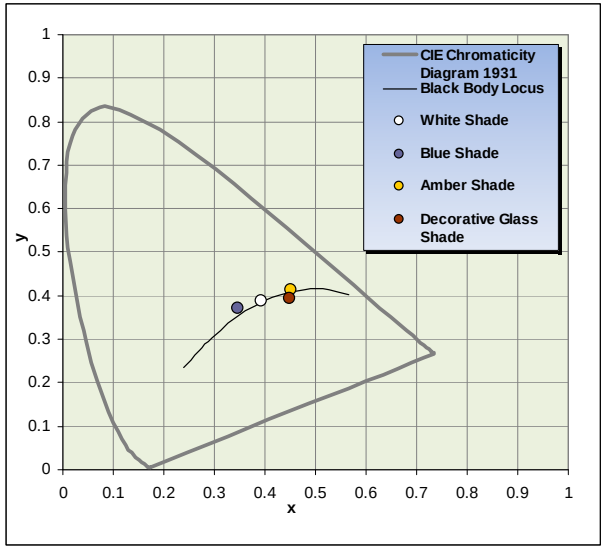
Luminaire Photometry

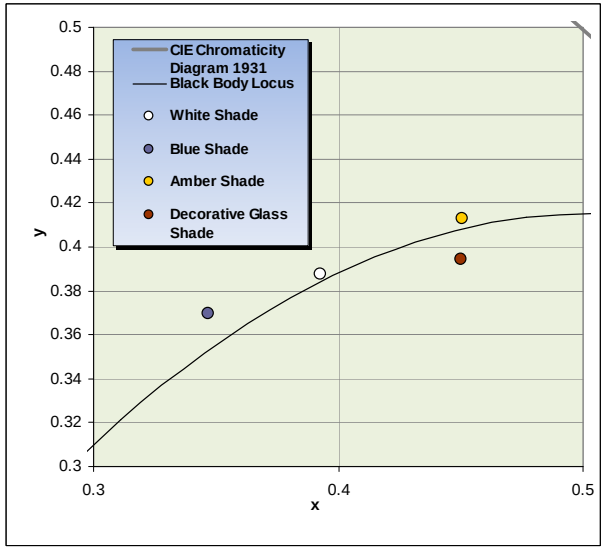
- Suitable for measuring white light luminaires: luminous efficacy, flux, CCT, CRI.
- Less useful for highly decorative luminaires:
  - Optical losses less critical
  - Lower performance expectations
  - Colorimetry at luminaire level generates data of dubious value

Luminaire Photometry

- IES LM-79-08 testing conducted at the Lighting Research Center (LRC) at Rensselaer Polytechnic Institute.
  - Fixtures from WAC Lighting, an LRC Partner
  - All fixtures: identical source, differing glass shades
  - Sarah series: white, amber, blue
  - Fiore series: decorative glass

Luminaire Photometry





Luminaire Photometry

Product Description	Ambient Temperature (°C)	Input Voltage (V)	Input Power (W)	Luminous Flux (lm)	Luminous Efficacy (lm/W)	x	y	CCT	CRI
White shade	24.7	120.11	4.48	165.0	36.83	0.3929	0.3876	3761	73.6
Blue shade	24.7	120.11	4.48	129.9	28.99	0.3468	0.3698	4998	72.0
Amber Shade	24.7	120.02	4.48	82.6	18.44	0.4507	0.4129	2851	69.0
Decorated glass	24.7	120.12	4.48	34.9	7.78	0.4499	0.3942	2711	78.1

Testing Decorative LED Fixtures Per IES LM-79-08

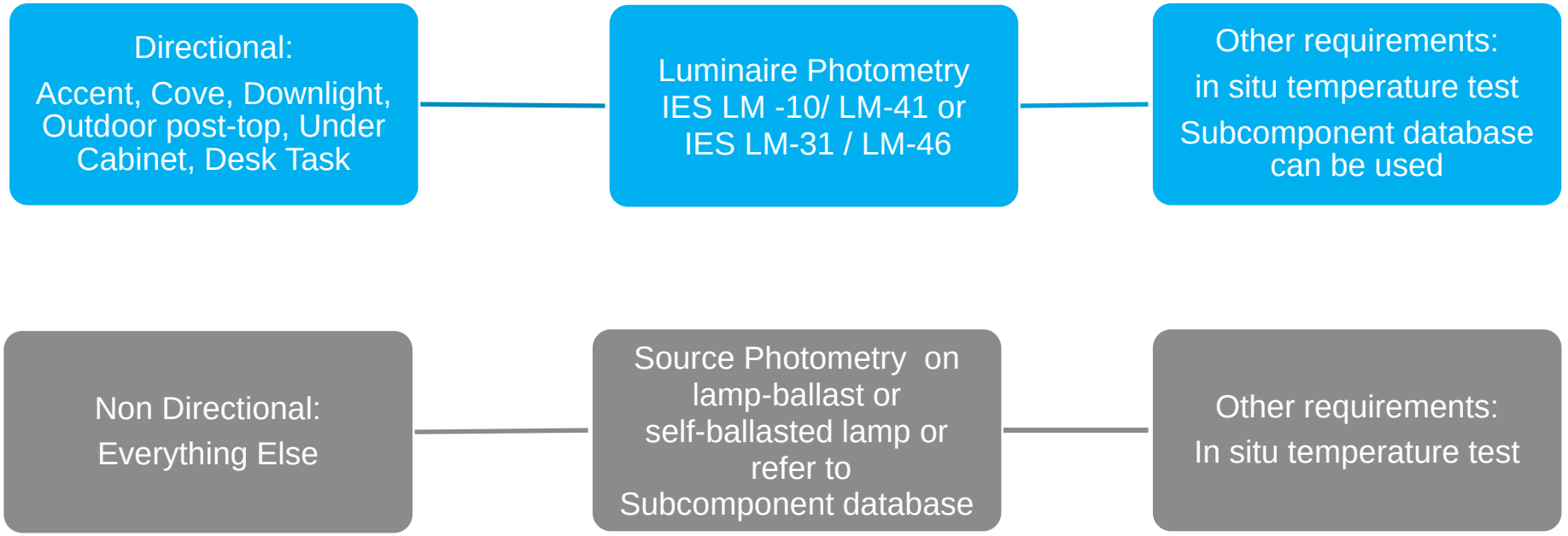
Lighting Research Center (NVLAP Lab Code: 200480-0)

2/13/2011

Non-Directional Luminaires

- Evaluated with source photometry: source lumens/input watt and do not include measurement of luminaire optical losses.
- Non-Directional Fixtures are not intended to illuminate specific surfaces.
- Category does not have specific scope – examples in specification.
- Includes minimum source light output requirements.
- The lamp & ballast platform, GU24 self-ballasted lamp, GU24 integral LED lamp, or LED light engine sources can also be listed in the Certified Lighting Subcomponent Database and can be used in many different fixtures.

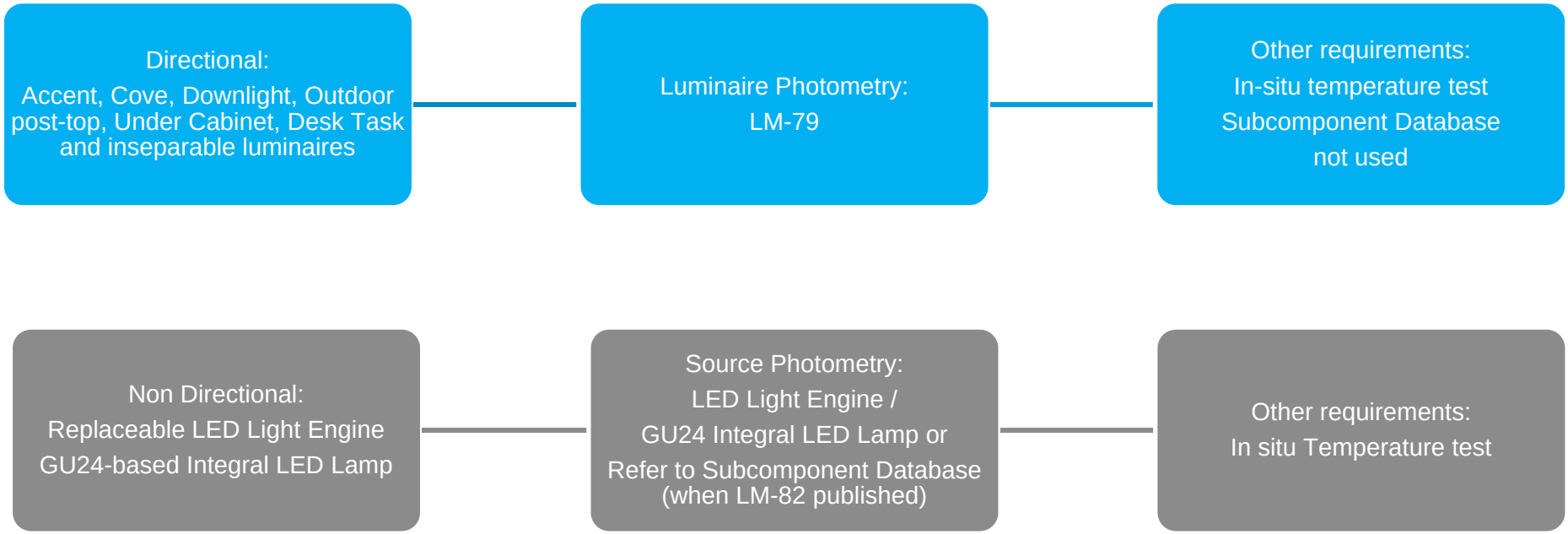
Fluorescent/HID Luminaires



Main Changes for Fluorescent Products

- NEMA/ALA Matrix will be replaced with a new database of third-party certified subcomponents.
- 3 year warranty applies to luminaire & source.

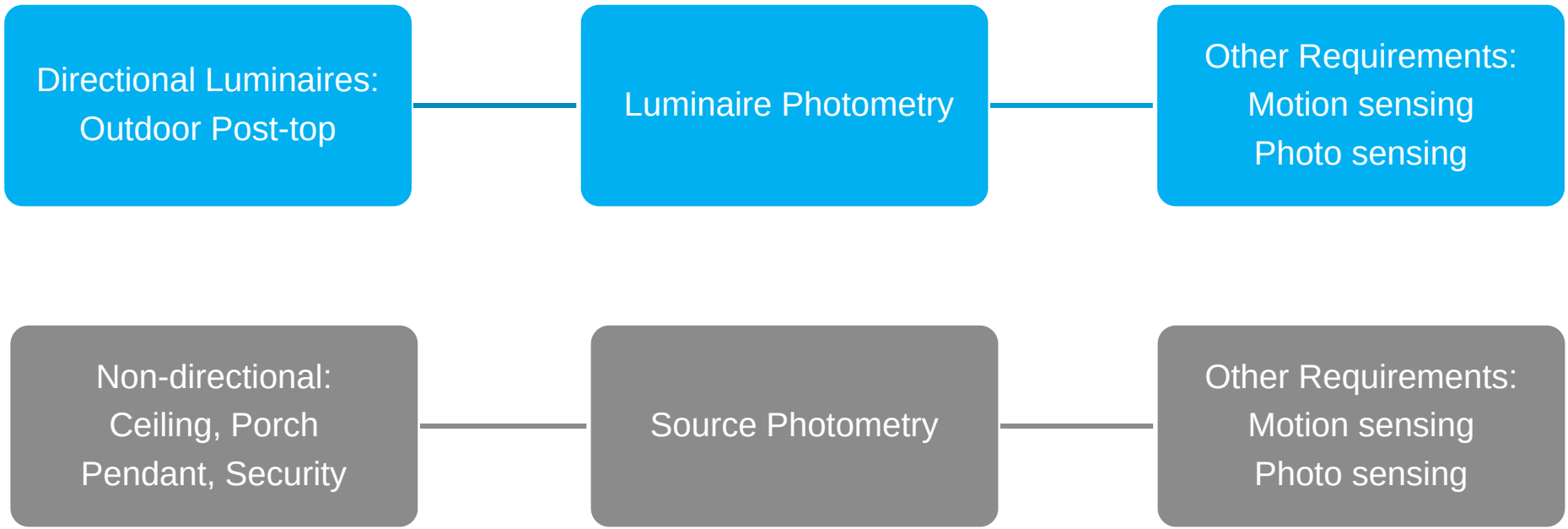
Solid State Lighting Luminaires



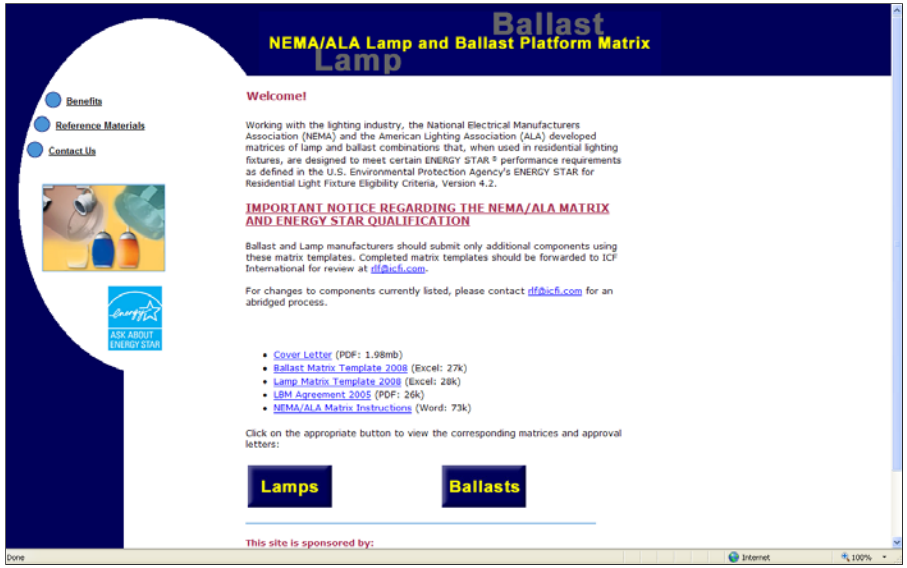
Main Changes for SSL Products

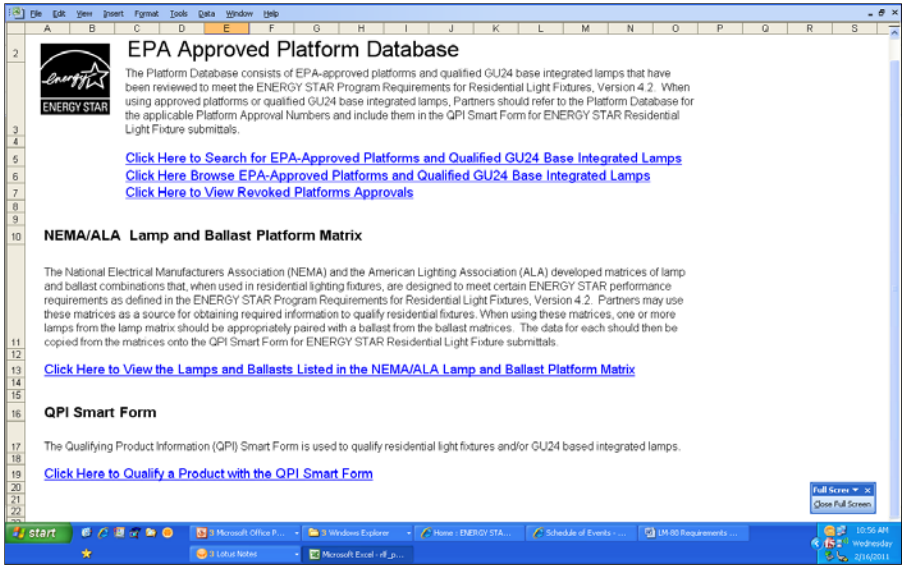
- Sample size increased to 3 luminaires, all 3 must meet the requirements.
- IES LM-80 sample size changed to 20 units to align with IES TM-21 recommendations. Sample size is the same for LED packages, arrays or modules.
- Non-directional luminaires must employ replaceable LED light engines or GU24 integrated LED lamps, and must meet source efficacy of 65 lm/W.
- Non-directional luminaires without source replaceability are classified as “inseparable SSL luminaires” – see Directional requirements: 70 lm/W luminaire efficacy, no zonal lumen density requirements.

Halogen Luminaires (Outdoor Only)



Certified Lighting Subcomponent Database





The NEMA/ALA Matrix and EPA Approved Platform Database will be replaced by the Certified Lighting Subcomponent Database.

www.energystar.gov/lightingsubcomponents

Certified Lighting Subcomponent Database

- Operational by March 31, 2011.
- Will include third-party certified performance data:
  - Lamps: fluorescent, HID
  - Fluorescent, HID ballasts
  - Lamp & ballast platforms (system performance)
  - GU24 self-ballasted lamps: fluorescent, HID
  - GU24 based integral LED lamps (when IES LM-82 is finalized)
  - LED light engines (when IES LM-82 is finalized)
- Possibly: LED package/array/module lumen maintenance data based on IES LM-80 tests and IES TM-21 projections.

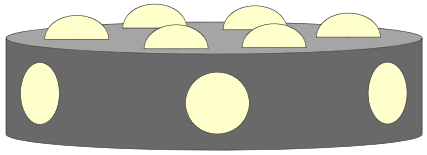
LED Light Engines

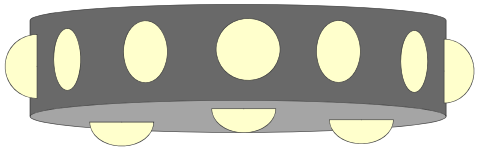
LED Light Engine:
An integrated assembly comprised of LED packages (components) or LED arrays (modules), LED driver, and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a custom connector compatible with the LED luminaire for which it was designed, and does not use an ANSI standard base. (IES RP-16-10).

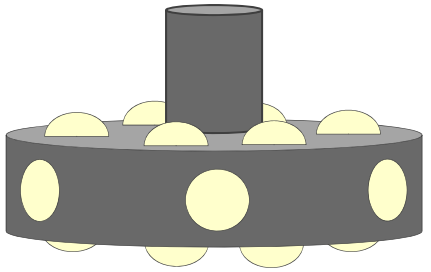
LED Light Engines

- Two ways to consider LED light engines:
  - As an object: a mechanically integrated unit
  - As a concept: a combination of LED driver + array
- Both testable using IES LM-82.
- GU24 based integrated LED lamps should also testable per IES LM-82.

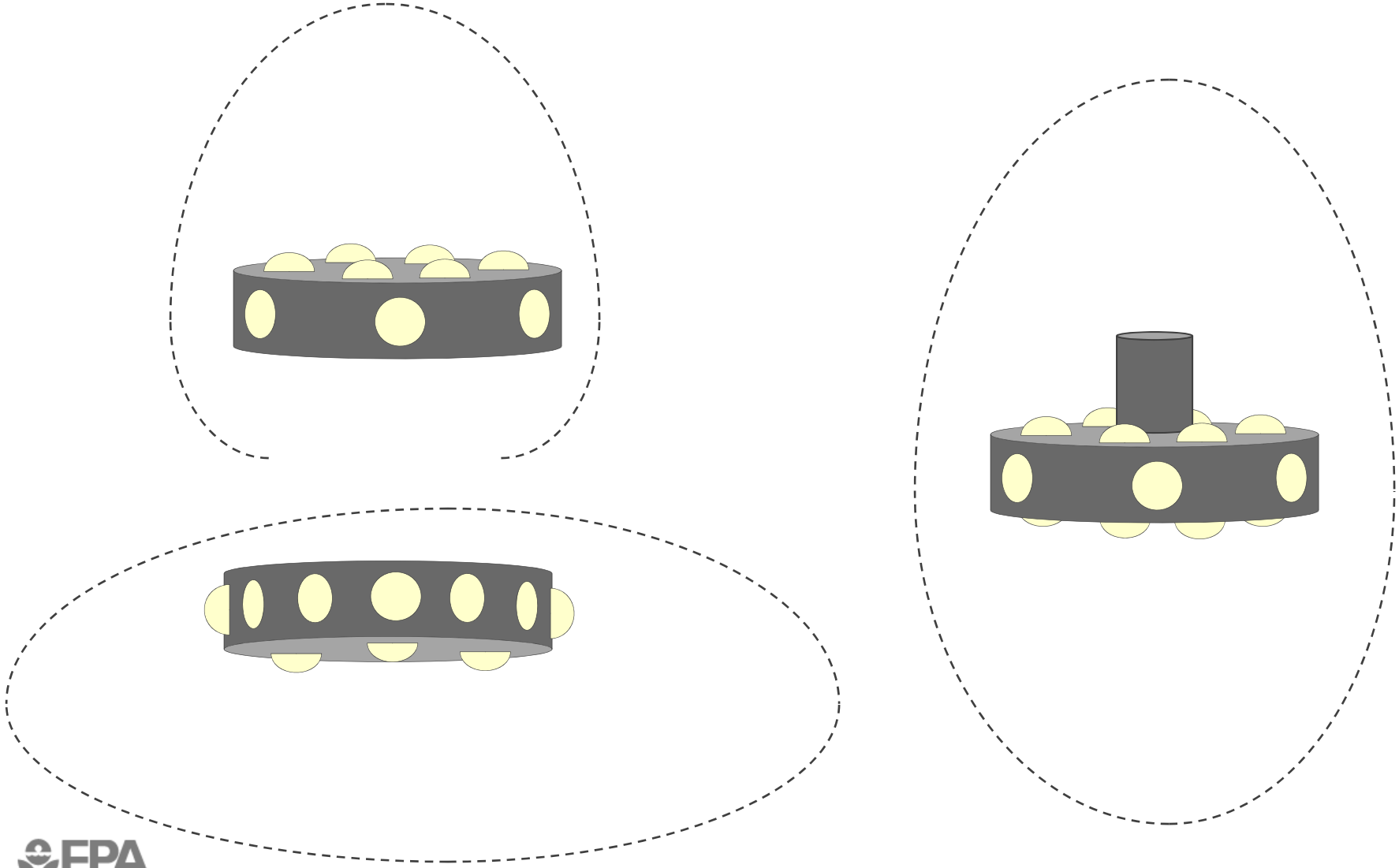
LED Light Engines





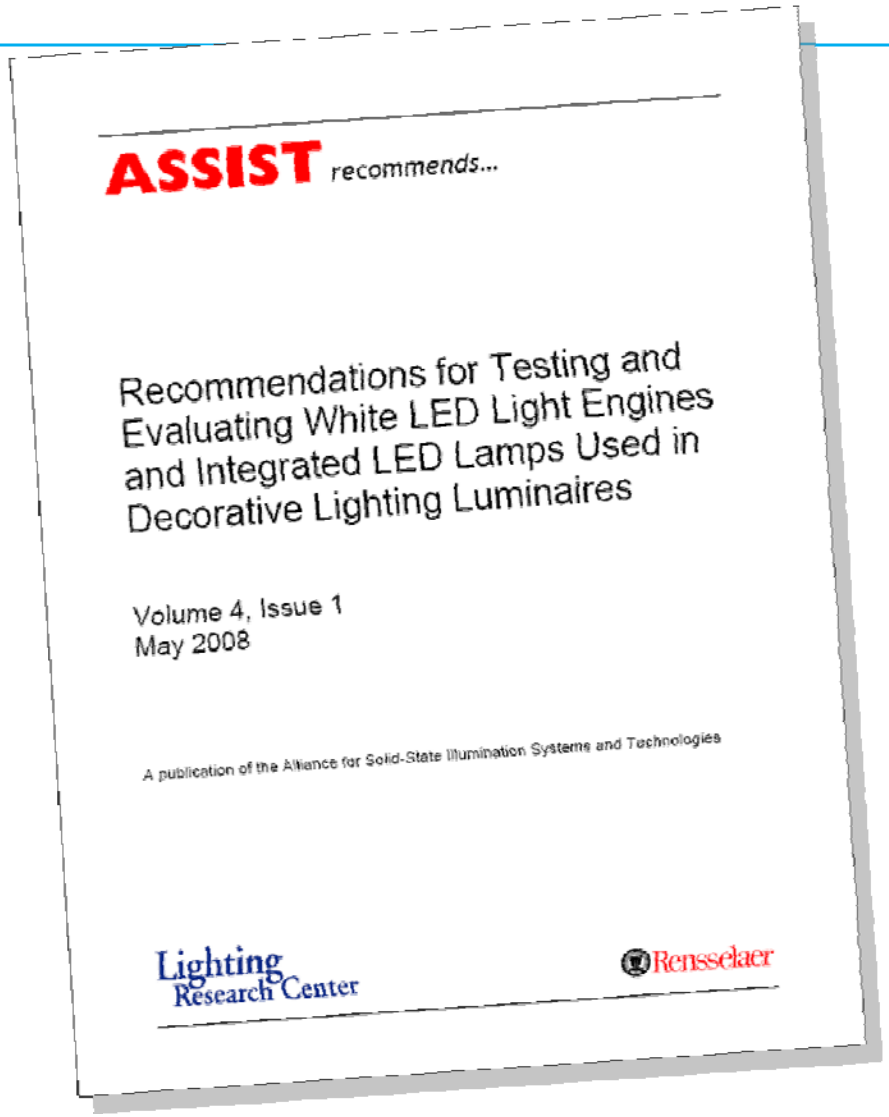


LED Light Engines



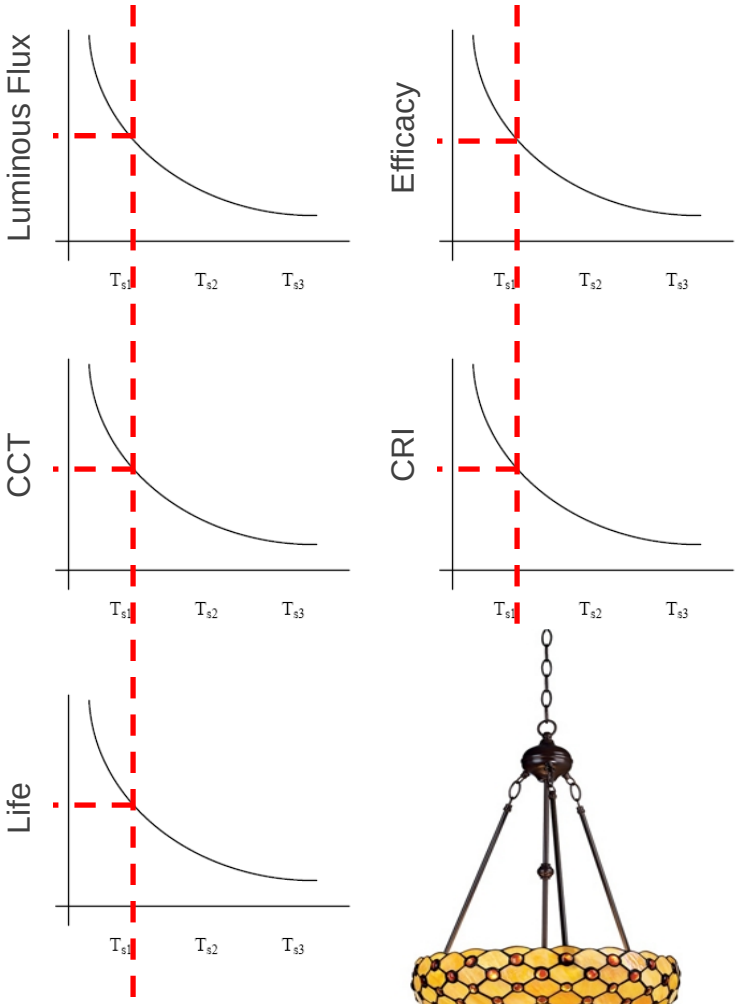
LED Light Engines

ASSIST: Recommendations for Testing and Evaluating White LED Light Engines



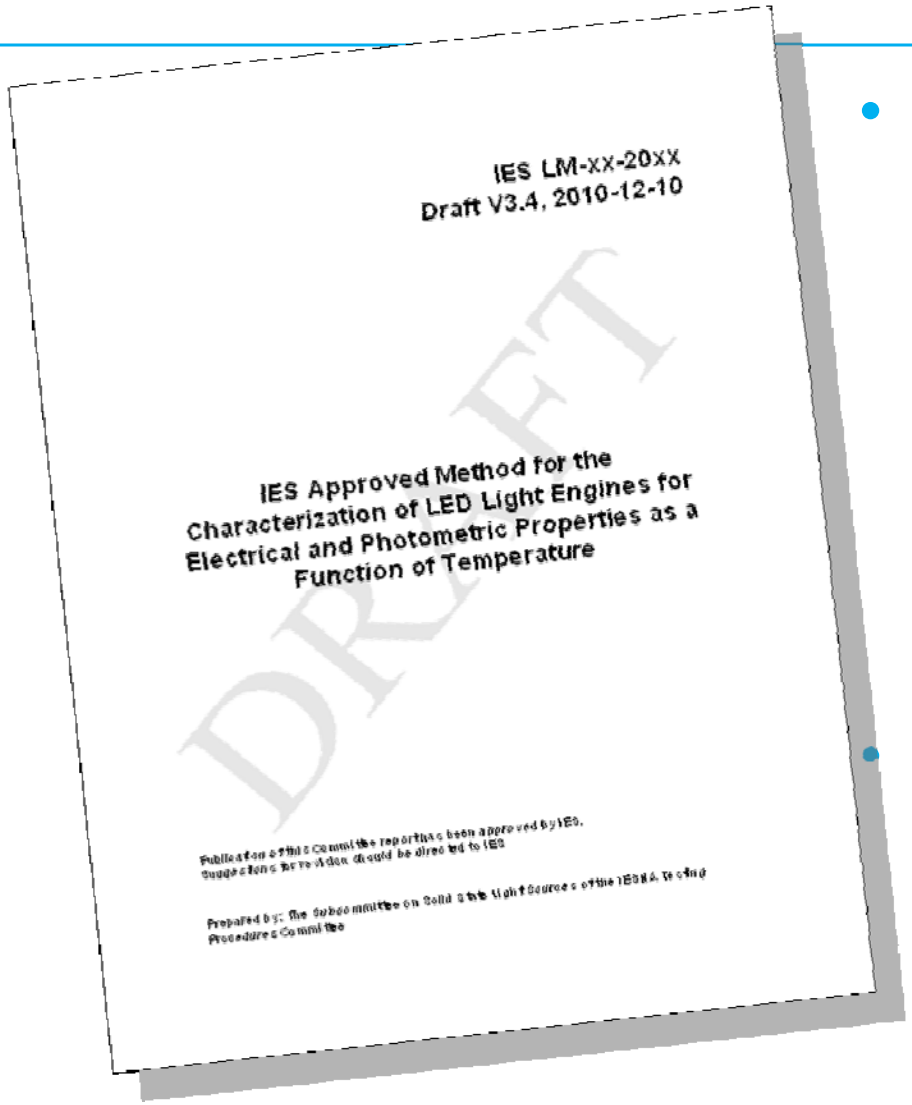
- At 60 C, 90 C and 120 C, measures:
  - Luminous flux (lm)
  - Luminous efficacy (lm/W)
  - Correlated color temperature (K)
  - General color rendering index (R_a)
  - Active power (W)
  - Power factor

Testing LED Light Engines



- Luminaire's in-situ operating temperature is used to determine how the LED light engine will perform in that fixture.
- In situ temperature is compared to the LED light engine's data curves to determine anticipated performance of the LED light engine when installed in the fixture.
- Example: in situ temperature is 63°C.

IES LM-82-11


IES LM-XX-20XX
Draft V3.4, 2010-12-10

IES Approved Method for the Characterization of LED Light Engines for Electrical and Photometric Properties as a Function of Temperature

DRAFT

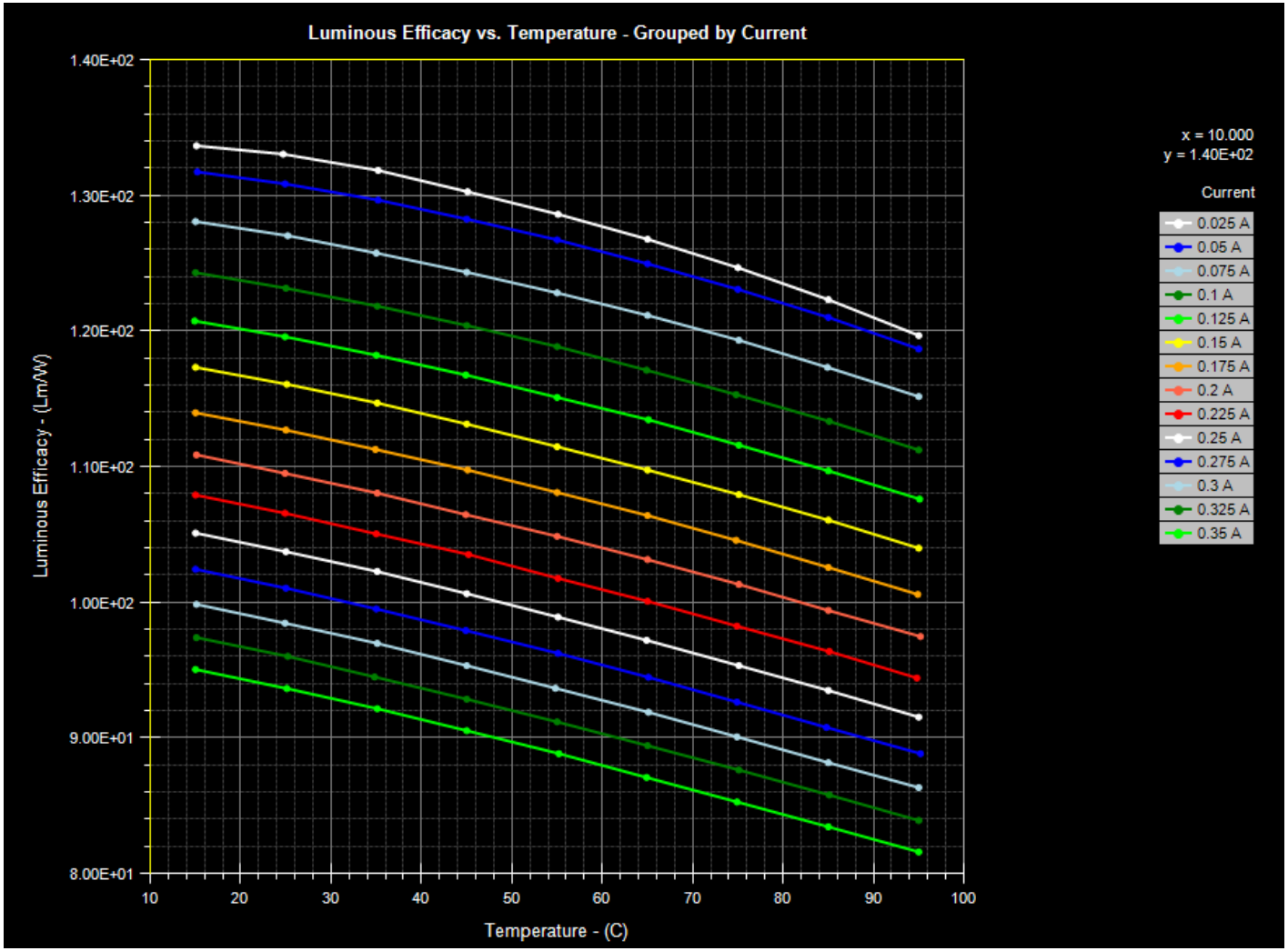
- IES LM-82-11: Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties <u>as a Function of Temperature.</u>

- IES LM-82 is not yet final but is required to test and certify non-directional fixtures using LED light engines or GU24 integrated LED lamps.

IES LM-82-11

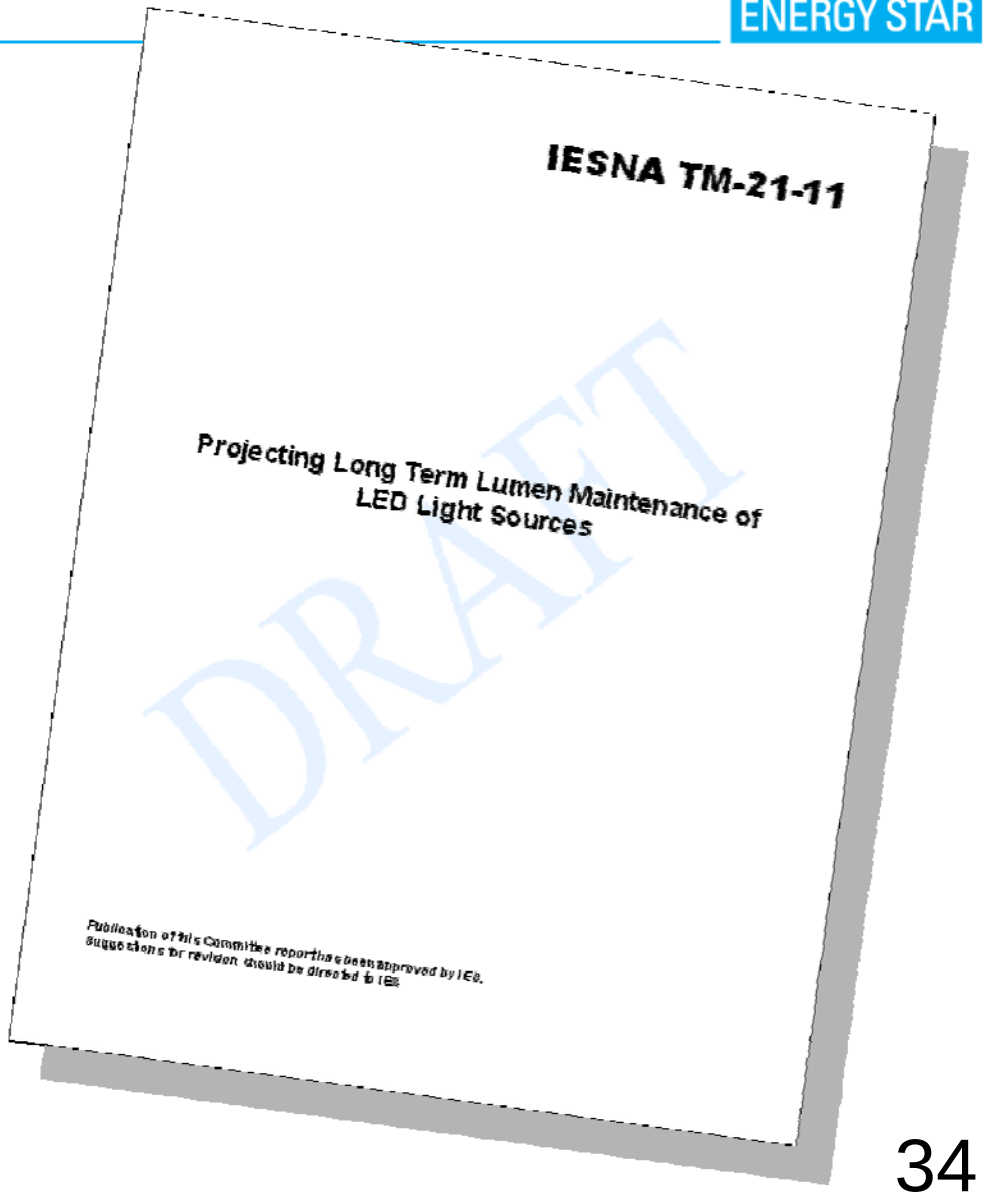
- Test procedure for evaluation of white LED light engines.
- **References IES LM-79 for all photometric and electrical measurements.**
- Essentially: "*LM-79 as a function of temperature*"
- Tests photometric, electrical performance at elevated temperatures:
  - Luminous flux (lm)
  - Luminous efficacy (lm/W)
  - Correlated color temperature (K)
  - General color rendering index (R_a)
  - Active power (W)
  - Power factor

IES LM-82-11


Luminous Efficacy vs. Temperature - Grouped by Current
1.40E+02
1.30E+02
1.20E+02
1.10E+02
1.00E+02
9.00E+01
8.00E+01
Luminous Efficacy - (Lm/W)
10
20
30
40
50
60
70
80
90
100
Temperature - (C)
x = 10.000
y = 1.40E+02
Current
0.025 A
0.05 A
0.075 A
0.1 A
0.125 A
0.15 A
0.175 A
0.2 A
0.225 A
0.25 A
0.275 A
0.3 A
0.325 A
0.35 A

IES TM-21-11

- IES TM-21-11: Projecting Long-Term Lumen Maintenance of LED Light Sources, currently in draft, should be complete by June.
- Covers LED packages, arrays, modules.
- Statistically significant sample size of 20 units recommendation adopted in Luminaires specification requirements.
- IES TM-21 is necessary for calculation of LED lumen maintenance using IES LM-80 data (Option 1).



IES TM-21 and Lumen Maintenance

- Option 1: Requires both IES LM-80 data of LEDs and IES TM-21 extrapolation to predict lumen maintenance.
  - No solid state luminaires can be qualified under Option 1 until IES TM-21 is published.
- Option 2: IES LM-79 testing of the fixture at 0h and 6000h with continuous interim operation in accordance with ANSI/UL 1598/1574 or 153.

EPA Recognition of Laboratories and Certification Bodies

Testing Requirements

- EPA recognizes lighting laboratories for photometric tests only.
  - Fluorescent
  - HID
  - SSL
  - Halogen
- Electrical safety testing must be carried out by an OSHA NRTL.
- EMI testing must be carried out by a laboratory that appears on FCC's list and with either NVLAP or A2LA accreditation.

Luminaires: Fluorescent

EPA recognition for testing fluorescent non-directional luminaires and subcomponents requires accreditation to all of the following test procedures:

- ANSI C78.376-2001
- ANSI C78.5-2003
- ANSI C82.11 Consolidated 2002
- ANSI C82.2-2002
- CIE Publication No. 13.3-1995
- CIE Publication No. 15-2004
- IES LM-9-1999
- IES LM-40-2001
- IES LM-65-2001
- IES LM-66-2000

To test directional luminaires, all of the above plus :

- IES LM-10-1996/2011
- IES LM-41-1998/2011

Luminaires: HID

EPA recognition for testing non-directional HID luminaires and subcomponents requires accreditation to all of the following test procedures:

- ANSI C78.389-2004
- ANSI C82.6-2005
- CIE Publication No. 13.3 – 1995
- IES LM-47-2001/2011
- IES LM-51-2000

To test directional luminaires, all of the above plus :

- IES LM-31-1995/2011
- IES LM-46-2004

Luminaires: Solid State

- EPA will not be recognizing laboratories for solid state non-directional until LM-82 is published.

- EPA will be recognizing laboratories for directional SSL (using LM-79), but products can only be qualified using lumen maintenance option 2 (6000h luminaire testing) until TM-21 is published.

Luminaires: Solid State

EPA recognition for testing non-directional solid state luminaires and subcomponents requires accreditation to all of the following test procedures:

- ANSI C78.377-2008
- ANSI C82.77-2002
- CIE Publication No. 13.3 – 1995
- IES LM-58-1994/2011
- IES LM-79-2008
- IES LM-82-2011 (when published)
- IES TM-21-2011 (when published)

To test directional Luminaires, all of the above plus :

- IES LM-79-2008, Section 10

Luminaires:
Halogen – Outdoor Only

EPA recognition for testing non-directional halogen luminaires and subcomponents requires accreditation to all of the following test procedures:

- IES LM-49-2001/2011
- Submission of laboratory's internal test procedure for motion sensing and photo sensing that demonstrates ability to competently test these fixtures

To test directional luminaires, all of the above plus:

- Evidence that a laboratory is equipped with a goniophotometer and accredited to either IES LM-79 section 10, IES LM-31-1991/2011, IES LM-46-2004, IES LM-10-1996/2011 or IES LM-41-1998/2011 to demonstrate competency to carry out luminaire photometry

Other Reference Standards

EPA recognized lab may also evaluate and provide documentation to CBs for the following standards:

- ANSI/ANSLG C78.42-2009
- ANSI/ANSLG C78.43-2007
- ANSI/ANSLG C78.81-2010
- ANSI/IEC C78.901-2005
- ANSI/ANSLG C81.61-2009
- ANSI/ANSLG C81.62-2009
- ANSI/ANSLG C82.14-2006
- ANSI C82.4-2002
- IEC 60061-1
- IEC 60081 Amend 4 Ed 5.0
- IEC 60901
- IEC 61347-2-3-am2 ed1.0 b.2006
- IEC 62321 Ed. 1.0
- NEMA LSD 45-2009
- NEMA LL 9-2009

Electrical Safety Requirements

Electrical safety testing must be carried out by an OSHA Nationally Recognized Testing Laboratory (NRTL)

- ANSI/IEEE C62.41-1991 (Transient Protection)
- ANSI/UL 153-2002
- ANSI/UL 935-2001
- ANSI/UL 1029-2010
- ANSI/UL 1310-2005
- ANSI/UL 1574-2004
- ANSI/UL 1598-2008
- ANSI/UL 1598B-2010
- ANSI/UL 1993-2009
- ANSI/UL 2108-2004
- ANSI/UL 8750-2009
- ASTM E283-04
- CAN/CSA C22.2 NO. 74-96 (R2010)

EMI Requirements

Electromagnetic interference testing must be carried out by an FCC, A2LA, or NVLAP-accredited laboratory

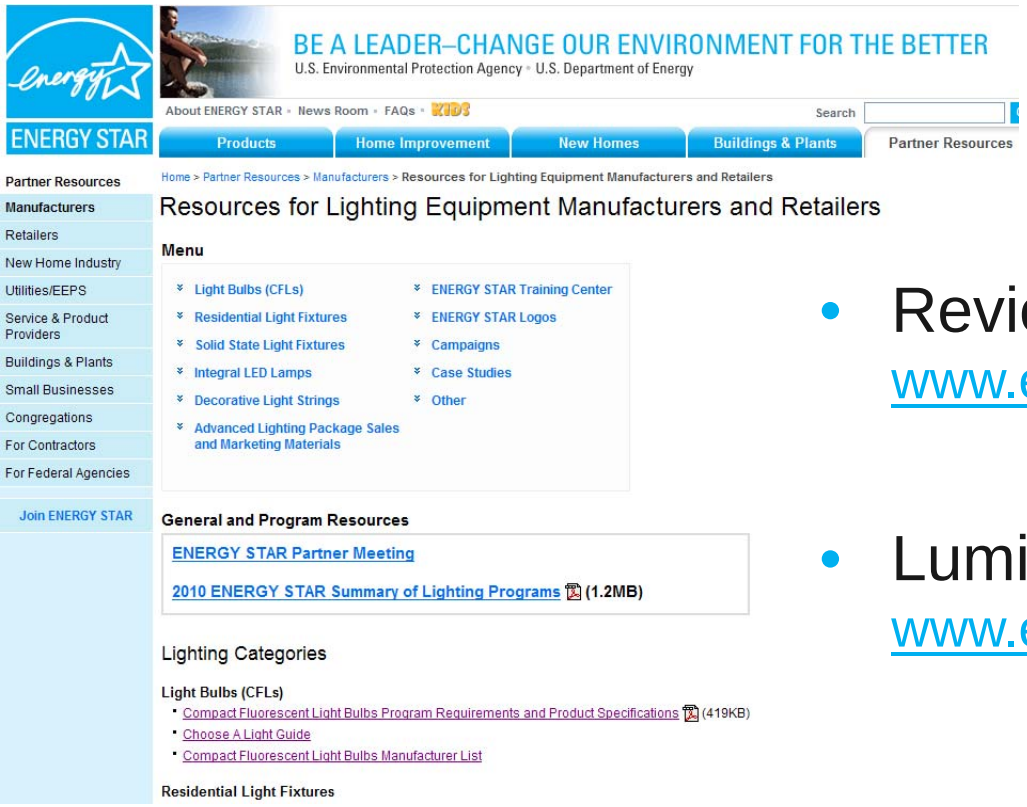
- FCC CFR Title 47 Part 15
- FCC CFR Title 47 Part 18

Steps to Participate

Steps to Participate

1. Review partner commitments and product specifications to determine eligibility.
2. Apply for partnership.
   a) Existing partners (RLF, SSL etc) must apply using a commitment form to add new programs to partnership.
   b) Manufacturers & private label brand owners new to ENERGY STAR must apply for partnership by completing the partnership application.
3. Select an EPA recognized certification body.
   a) Submit products to an EPA recognized test lab.
   b) Submit test results to an EPA recognized certification body.
   c) Certify product(s).
4. Qualify a product and adhere to partner commitments.
5. Participate in verification testing.

Step 1: Review Product Specifications to Determine Eligibility

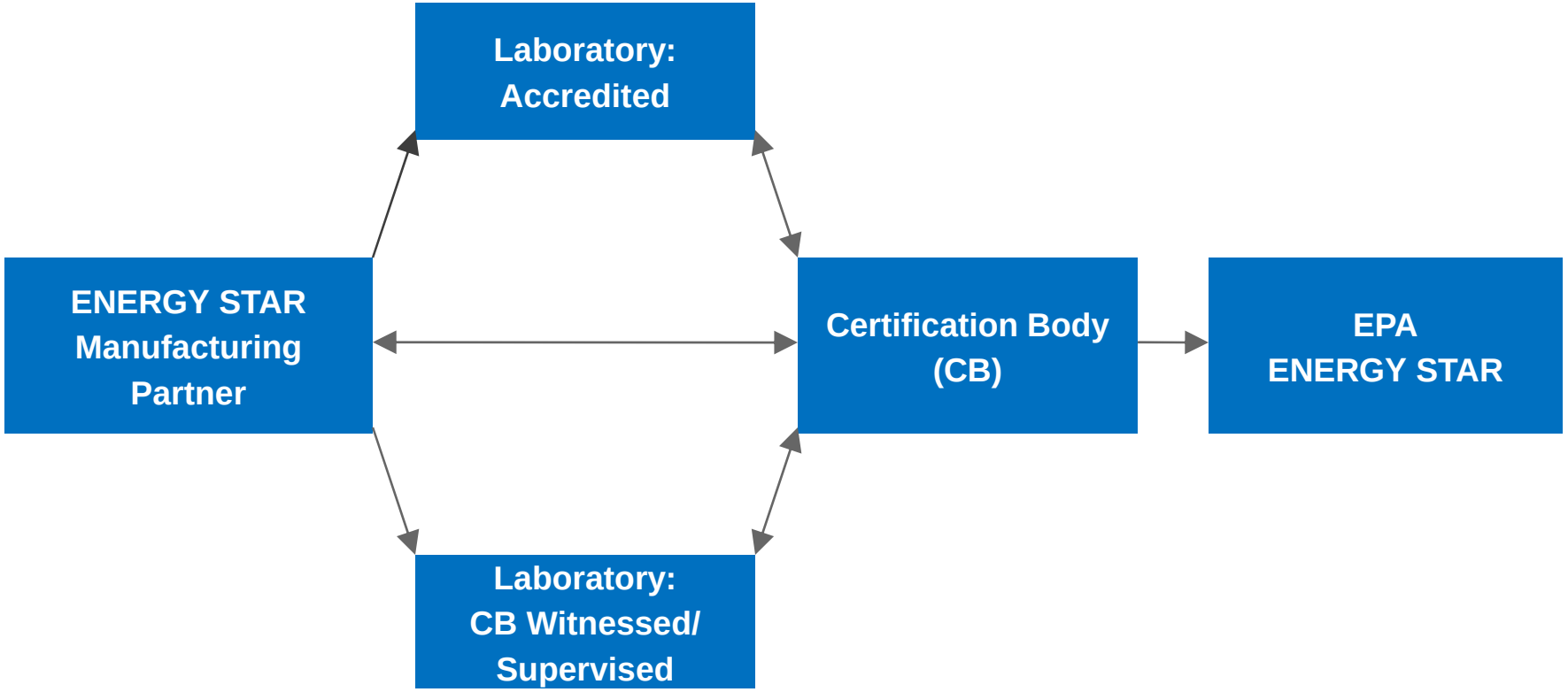


- Review product specifications at www.energystar.gov/lightingresources
- Luminaires specification www.energystar.gov/luminaires

Step 2: Apply for Partnership

- Partnership application and commitment form available soon.
- Manufacturers new to ENERGY STAR can apply at www.energystar.gov/join
- Parties interested in the luminaires program (not already receiving updates) can email Luminaires@energystar.gov
- EPA will notify interested parties when new partnership application is available.

ENERGY STAR Qualification Process

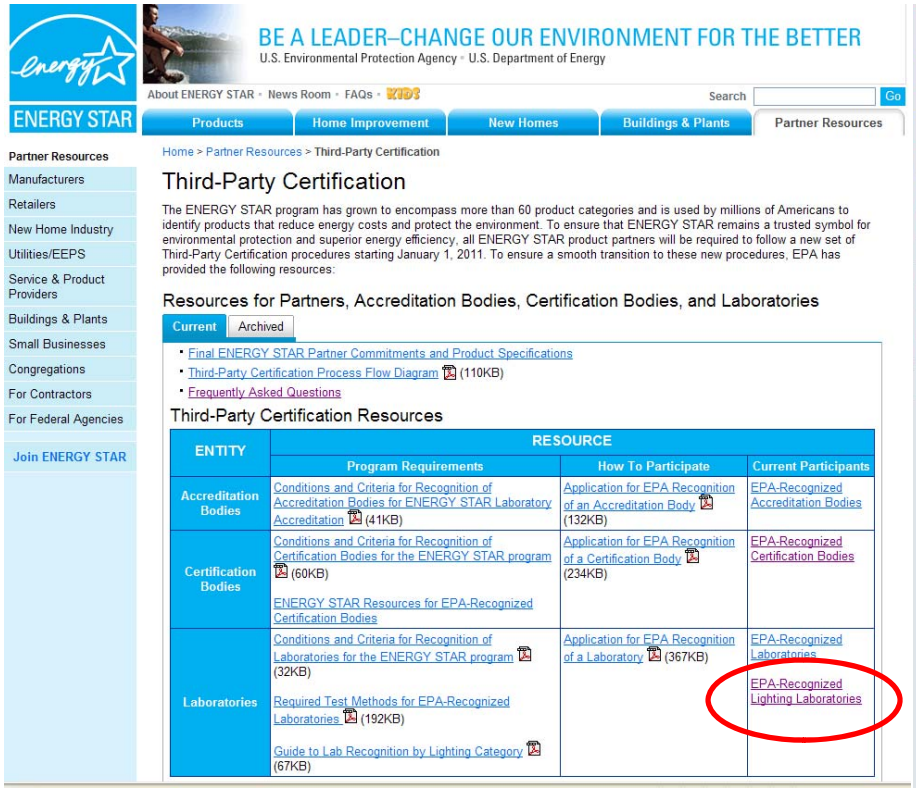


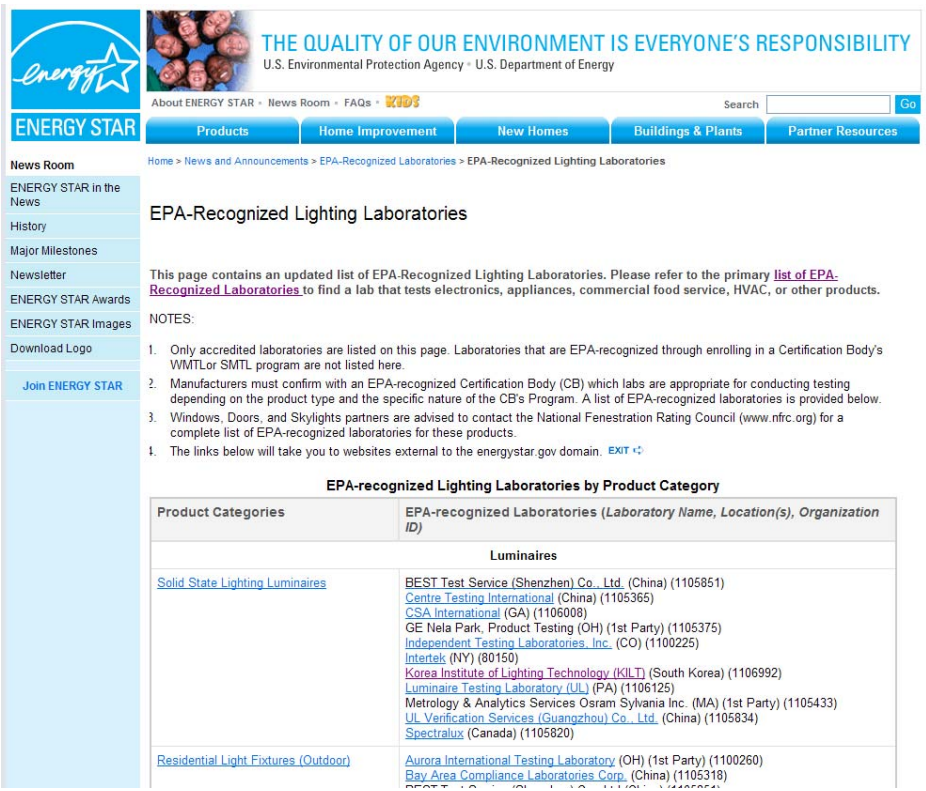
Step 3:
Select an EPA-Recognized Certification Body

Lighting	
Decorative Light Strings	Advanced Compliance Solutions, Inc., Bureau Veritas, CSA International, Intertek, Keystone Certifications, TUV SUD America, Inc., UL
Lamps	Advanced Compliance Solutions, Inc., Bureau Veritas, CSA International, Intertek, Keystone Certifications, TUV SUD America, Inc., UL
Luminaires	Advanced Compliance Solutions, Inc., Bureau Veritas, CSA International, IAPMO R&T, Intertek, Keystone Certifications, TUV SUD America, Inc., UL

www.energystar.gov/3rdpartycert

Step 3:
Select an EPA-Recognized Lighting Lab

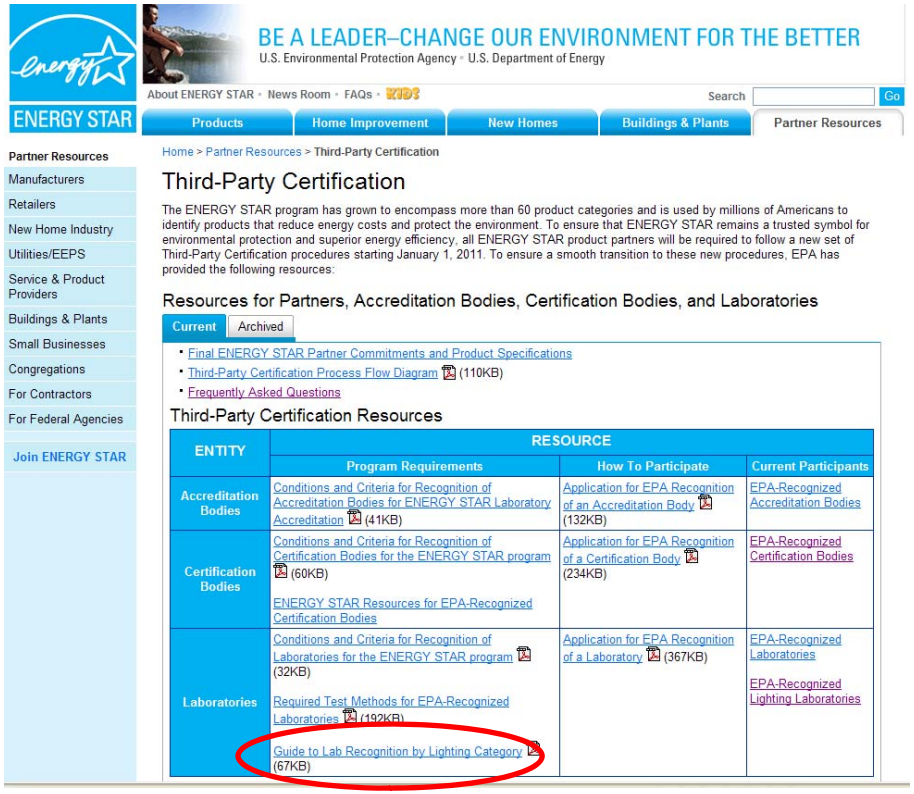




www.energystar.gov/3rdpartycert

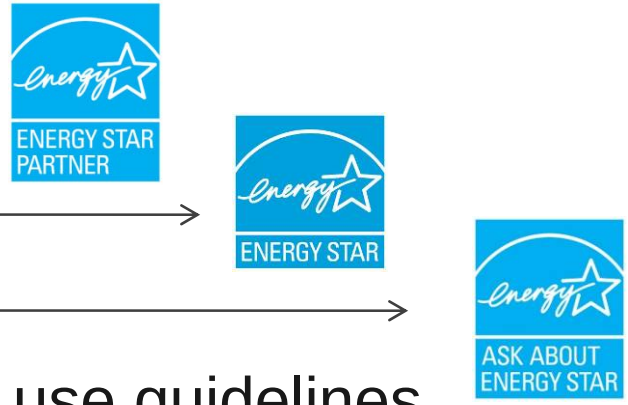
Step 3:
Select an EPA-Recognized Lighting Lab

- Specific requirements for recognition will be detailed in the updated Guideline for Laboratory Recognition, which will be online soon at: www.energystar.gov/3rdpartycert



Step 4: Qualify a Product and Adhere to Partner Commitments

- Receive confirmation of certification from CB
- Adhere to ENERGY STAR identity guidelines in addition to other partner commitments.
  - Types of logos are there?
    - Partnership mark
    - Certification mark
    - Promotional mark



Visit energystar.gov/logos for logo use guidelines.

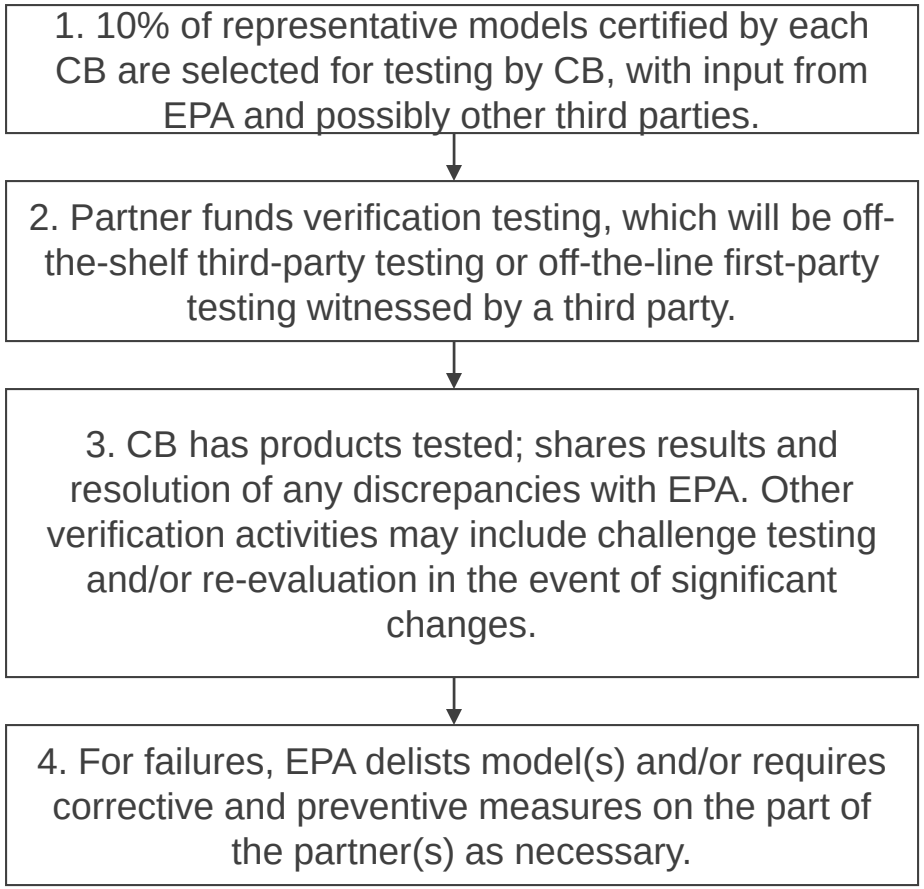
Always ensure marks are downloaded from EPA.

Qualified Product Lists

- New Luminaires qualified product list (QPL) will be found at www.energystar.gov/lightfixtures (not yet active)
  - As soon as laboratories are recognized for Luminaires specification (no laboratories are currently recognized) products can be certified and listed on the Luminaires QPL.
  - SSL certification of directional fixtures using IES LM-80 data not possible until IES TM-21 is published.
  - SSL non-directional certification is not possible until IES LM-82 is published.
  - Currently qualified RLF or SSL will not be automatically rolled over to the Luminaires QP list.
- The current Residential Light Fixture and Solid State Lighting Qualified Products Lists will remain posted until September 30, 2011.

Step 5: Participate in Verification Testing

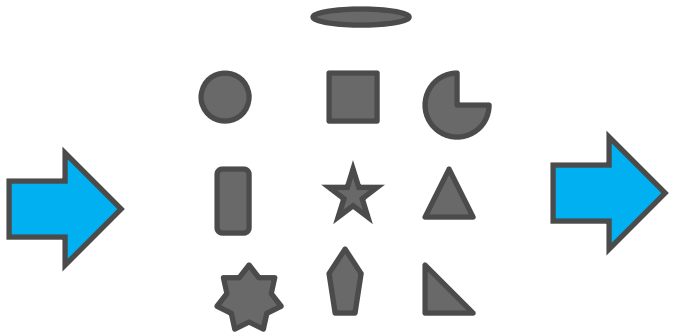
- Verification testing ensures products continue to meet ENERGY STAR requirements.
- New policies forthcoming.



Step 5: Participate in Verification Testing

- 10% minimum of all product qualified per CB.
  - Products derived from representative models are subject to verification testing, but no more than one product per family would be tested per year.

35 total fixtures qualified by CB



10 unique model numbers

10% of 10 unique model numbers = minimum of 1 fixture to be tested for verification

Timeline

January 1, 2011:
Third Party Certification goes into effect for all products

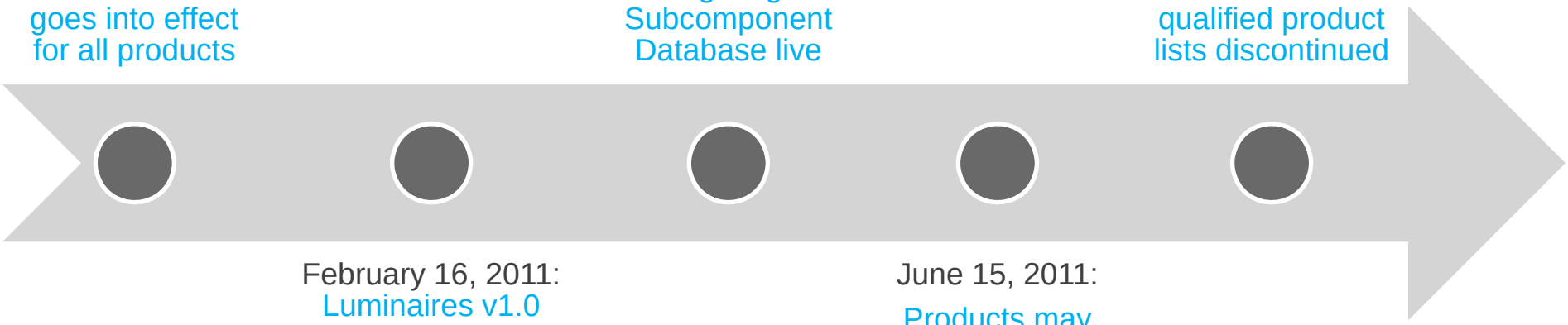
February 16, 2011:
Luminaires v1.0 Final

March 31, 2011:
Certified Lighting Subcomponent Database live

June 15, 2011:
Products may only be certified to Luminaires V1.0

October 1, 2011:
Luminaires v1.0 Effective date

SSL & RLF qualified product lists discontinued



Timeline

- Once laboratories are recognized for the new Luminaires categories, CBs may begin certifying products to the Luminaires specification.
- Products can be qualified to the existing SSL Luminaires V1.3 (SSL) or Residential Light Fixtures V4.2 (RLF) specifications until **June 15, 2011**.
- The RLF or SSL qualified product lists will not be maintained after **October 1, 2011.**
- Products qualified under the old specifications will NOT be grandfathered into the new program, and partners must cease ENERGY STAR labeling of these products by **October 1, 2011**.
- Today's webinar will be posted on the Luminaires page:

www.energystar.gov/luminaires

Thank You! Questions?

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www.energystar.gov/luminaires

www.energystar.gov/3rdpartycert

www.energystar.gov/lightingsubcomponents