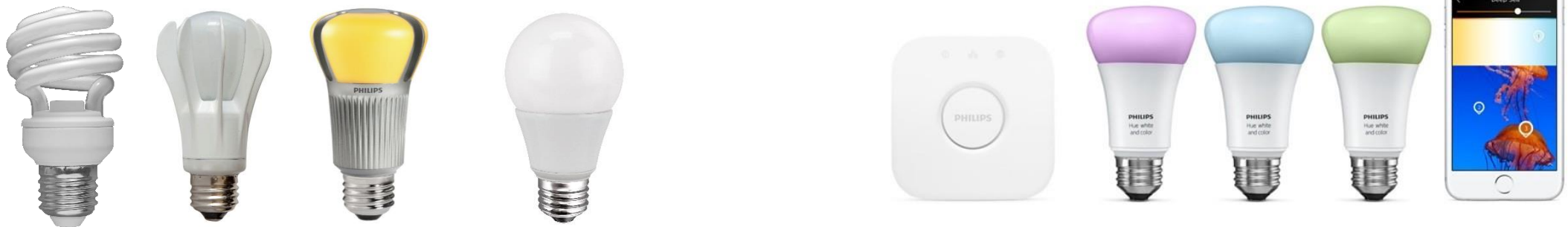




ENERGY STAR® Lighting Update



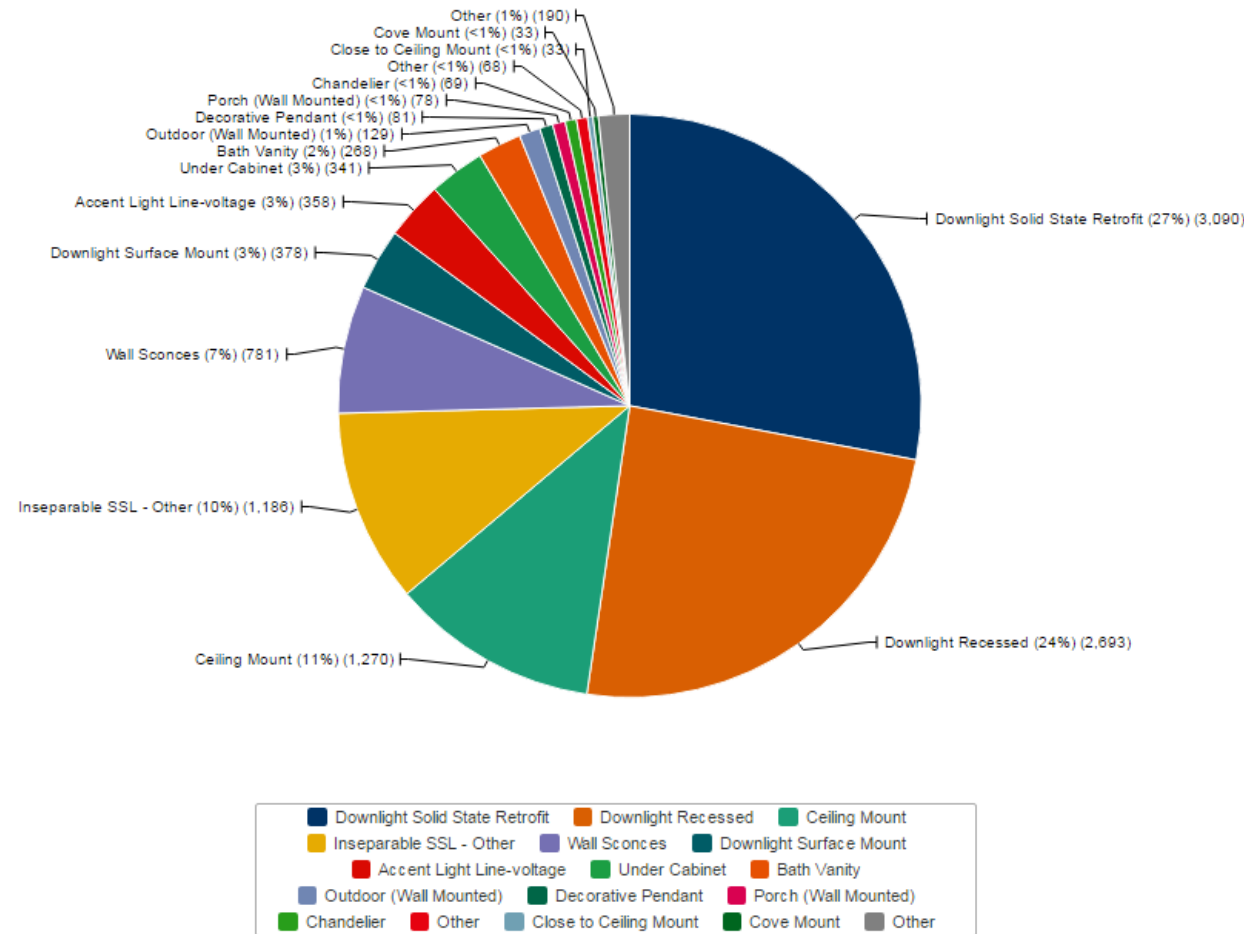
Technical Updates

- Luminaires 2.0
- Lamps 2.0
- Technical Webinar Series
- Calculator & Tool Updates
- Verification Testing Update
- Other Initiatives & Plans for 2017



ENERGY STAR Luminaires Version 2.0

- Finalized May 29, 2015
- Effective June 2016
- To date more than **11,000** products have been certified
- Ship with screw based ENERGY STAR certified bulb (10%)
- New retrofit kits categories (ceiling mount and wall sconce)
- Streamlined and simplified testing
- Standby limits for connected luminaires



Luminaires V2.0 By Type



ENERGY STAR Luminaires Version 2.1 Revision Plans

- Minor point revision doesn't affect products already certified
- Addition of updated standards
 - IES LM-80-15
 - IES TM-21-Addendum B
 - ANSI C78.377-2015 Updated CCTs
- Other Considerations
 - ANSI Driver Robustness Test
 - Shipping with Directional ENERGY STAR Lamps
 - Start time accommodation for fade to on products

ENERGY STAR® LUMINAIRES SPECIFICATION V2.0

The simple choice for energy efficiency.



January 2016

Objectives & Key Changes

Streamlined & Simplified

- Forget what you know about ENERGY STAR Luminaires -- Version 2.0 is an entirely new way to certify luminaires.
- Removal of socket restrictions
- New option to satisfy most testing requirements by including an ENERGY STAR Certified Lamp
- Sample size reductions for 11 requirements
- New ways to share test data among similar products
- Aligned requirements for cove and under cabinet lights
- Simplified minimum light output requirements
- Removal of separate commercial levels

"ENERGY STAR Luminaires Version 2.0 maintains most of the elements of the existing specification, while incorporating input from stakeholders and new, easier, and more flexible pathways for certifying a wide variety of energy saving light fixtures."

- Taylor Jantz-Sell ENERGY STAR Lighting Program Manager U.S. EPA

New certification pathway

1. Take a fixture with standard ANSI socket
2. Insert an ENERGY STAR Lamp that is rated for the type of fixture
3. Pass thermal test (if enclosed)
4. Get packaging approved
5. New ENERGY STAR certified Luminaire!



Adjusted scope & increased flexibility

- Expanded definition of LED Light Engines
- Additional retrofit-kit products added for wall sconces and ceiling mount luminaires
- Testing guidance for measuring color-tunable luminaires
- Elimination of exemption to ship without light sources
- New controls section with criteria for connected luminaires



Other changes

- ▶ Outdoor products can be decorative or directional (testing exemptions for Dark Sky compliant products)
- ▶ Downlight retrofit kit testing revised to represent worst case can installation per UL1596C
- ▶ Positive R9 requirement for SSL
- ▶ Adjusted color angular uniformity requirement

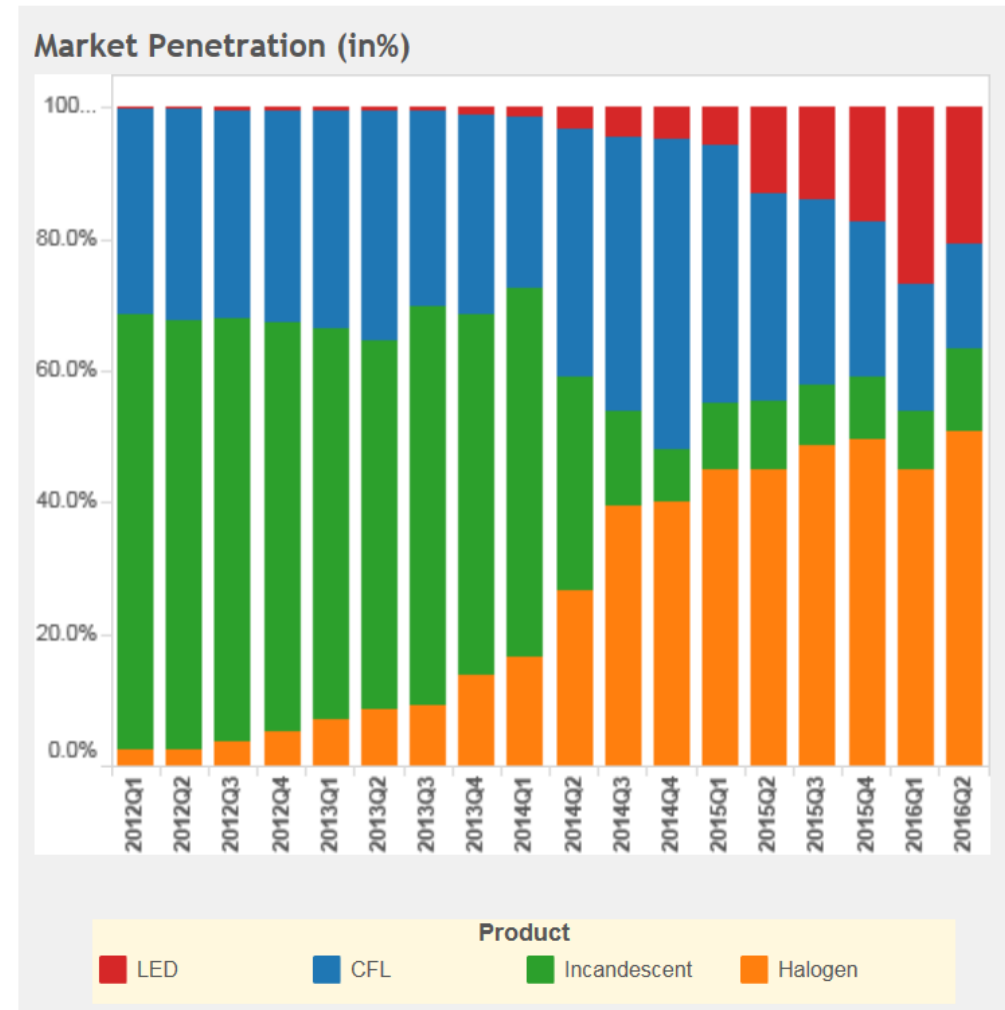
Key Milestones

Starting December 1, 2015 All new Luminaires must be certified to V2.0
June 1, 2016 Luminaires V2.0 Effective Date

Resources

- For more info visit www.energystar.gov/luminaires or contact: lighting@energystar.gov.

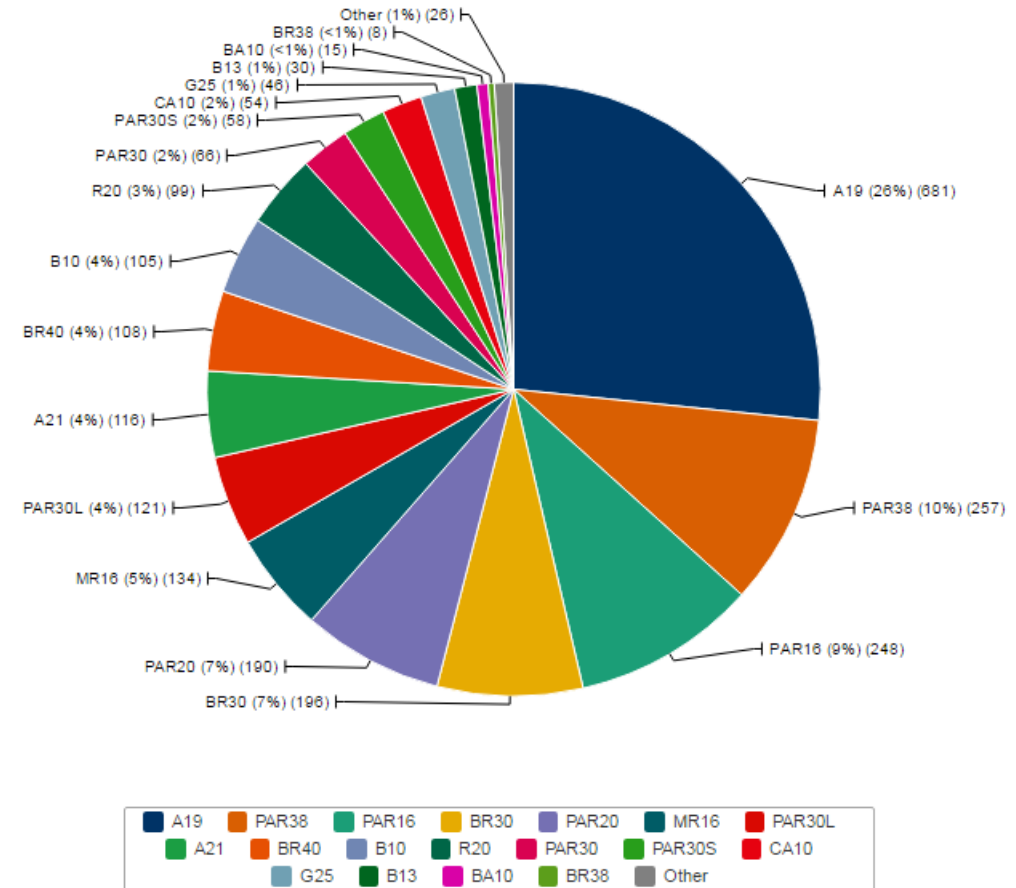
More than half of sockets in the U.S. still have an inefficient bulb



NEMA Lamp Indices – 2016 Q2

ENERGY STAR Lamps Version 2.0

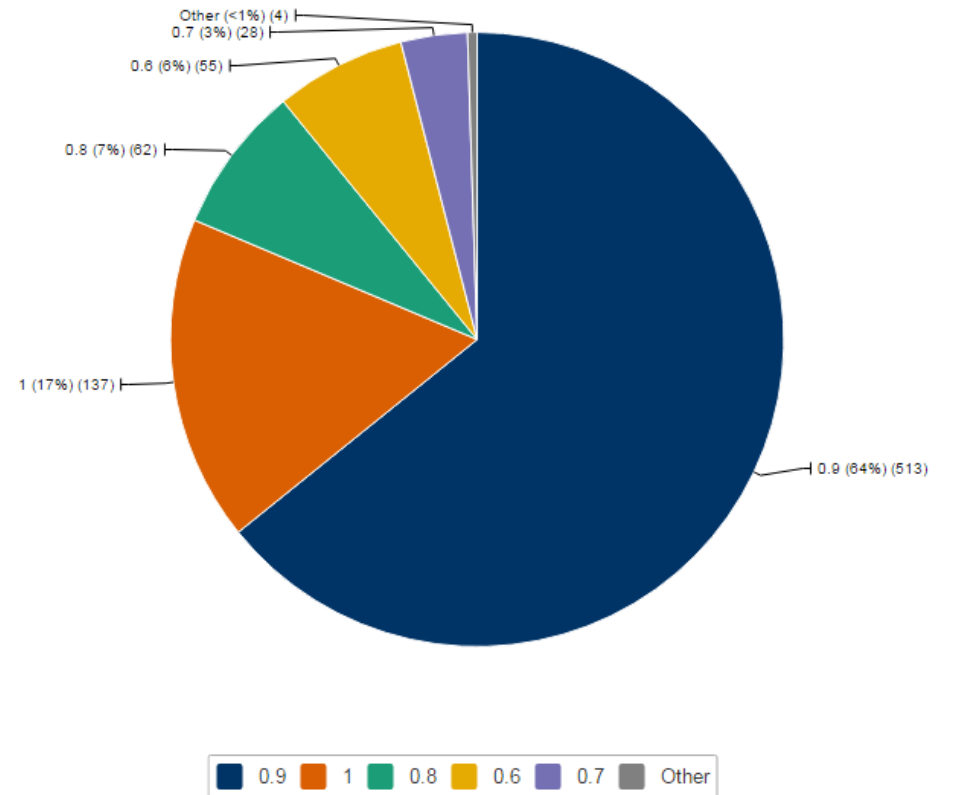
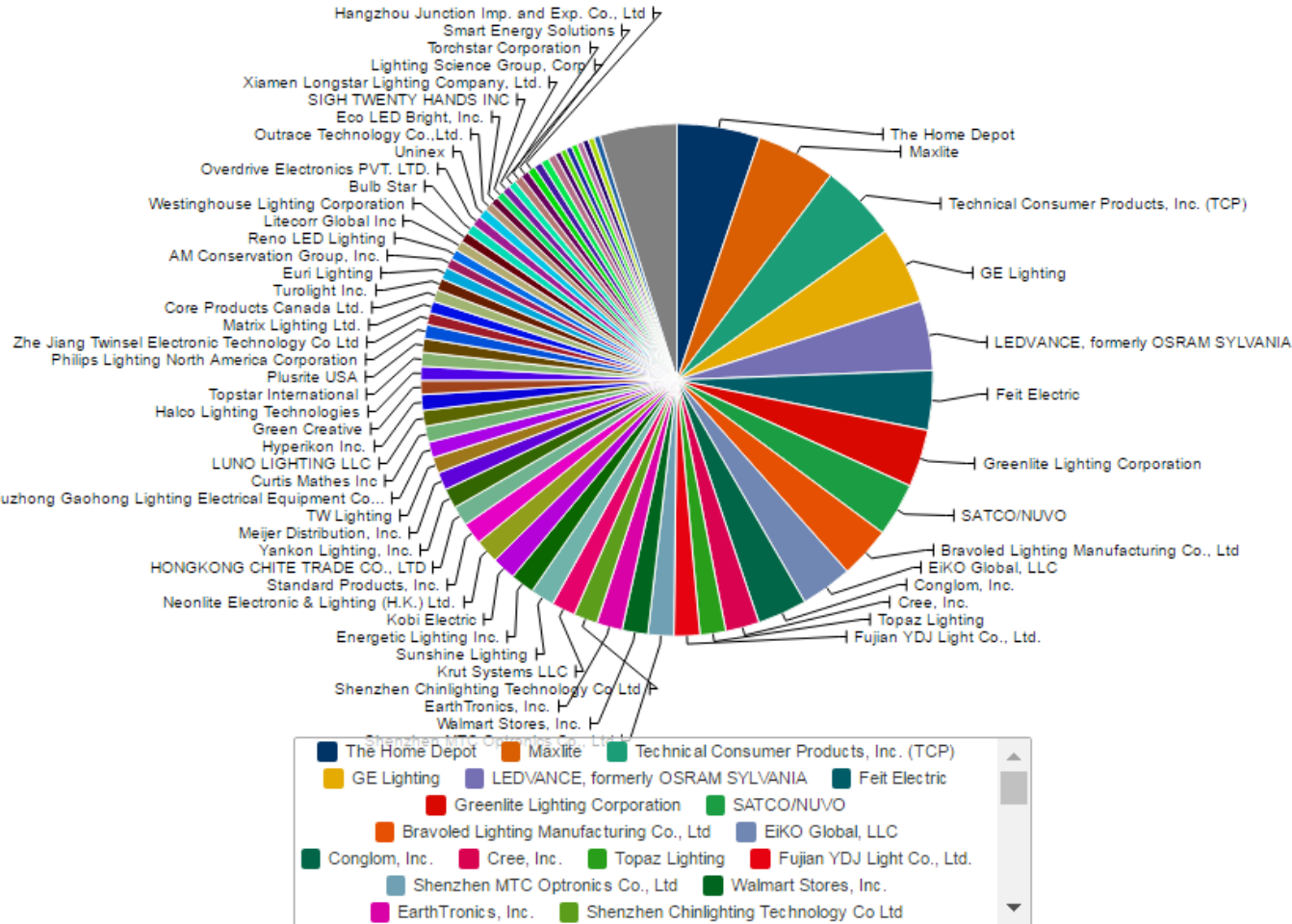
- Final December 31, 2015 **OPEN FOR BUSINESS** Effective Jan 2017
- More than **2600** lamps have been certified to Version 2.0!
 - **830+ Omnidirectional**
- Increased efficacy levels for all lamp types.
- **Expanded scope:** connected lamps, color tunable lamps, self-ballasted induction-driven electrodeless lamps, 2200K & 2500K filament.
- Improved alignment with the Luminaires V2.0 specification.
- Allows for use of DOE test procedures
- Standby limits for connected lamps
- Adjustments to omnidirectional lamp criteria to allow for cost reductions while maintaining high levels of quality: omnidirectionality, power factor, lifetime
- **[Learn more at energystar.gov/lamps](http://energystar.gov/lamps)**. Check out the [list](#).



Lamps V2.0 By type

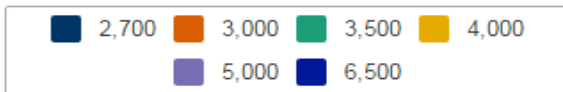
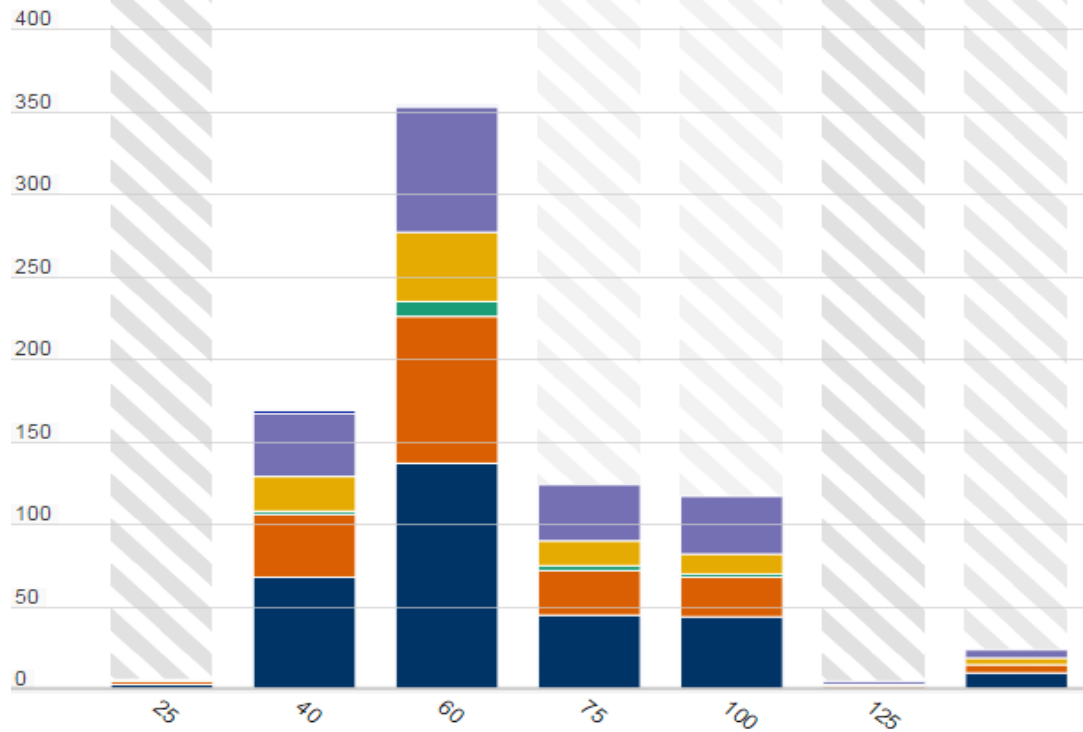


ENERGY STAR Lamps Version 2.0

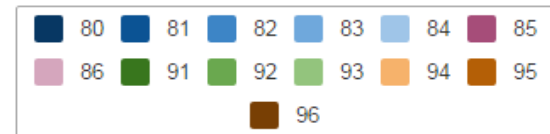
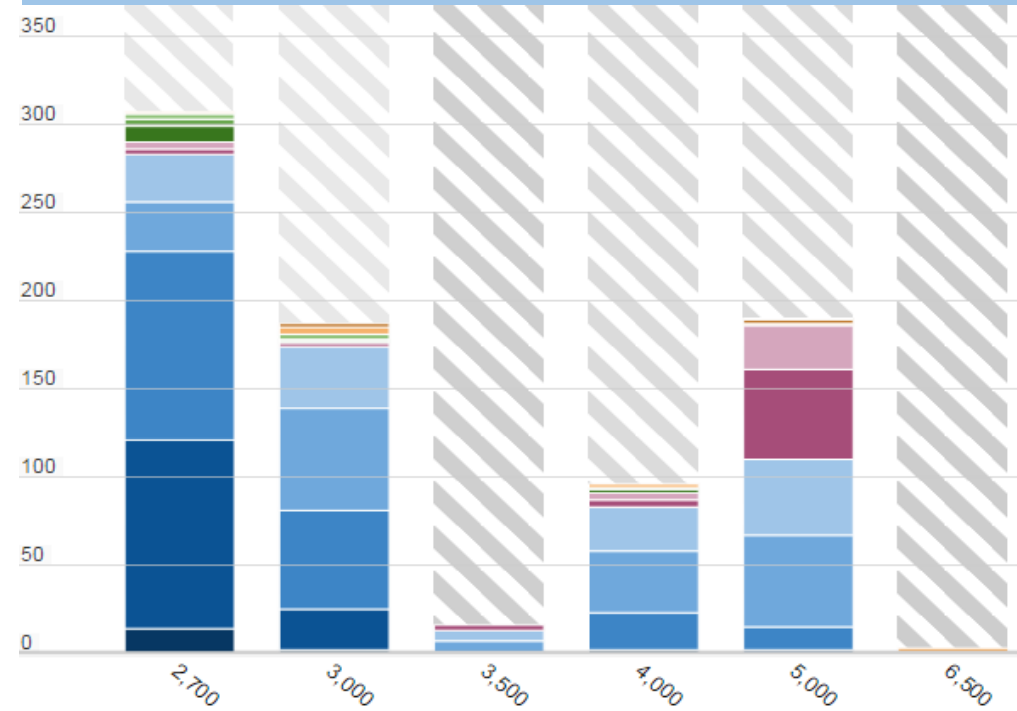


ENERGY STAR Lamps Version 2.0: Click link for updated tables

Wattage equivalency & CCT (A-Lamps)

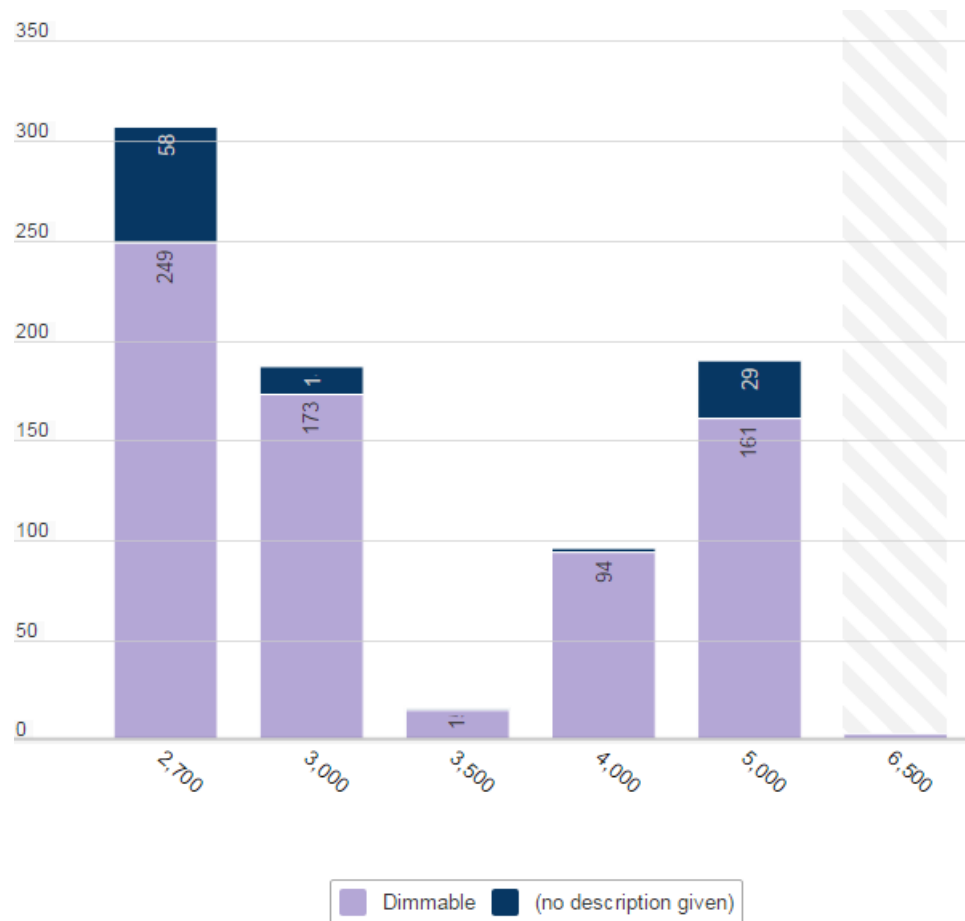


CCT and CRI (A-Lamps)

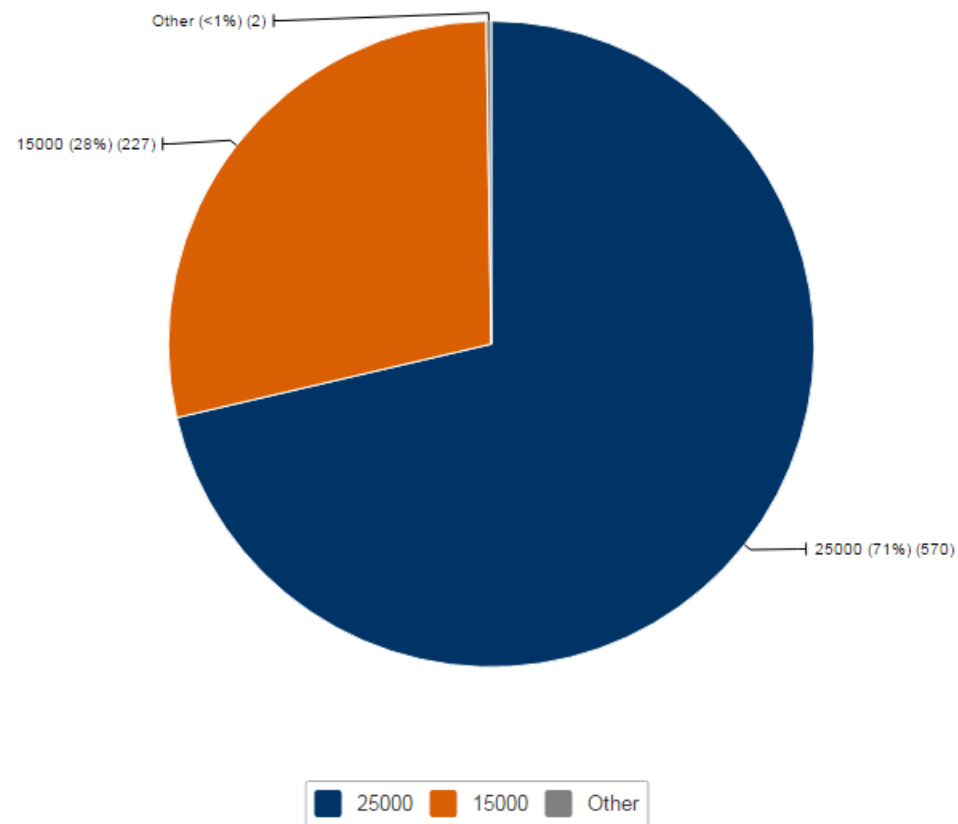


ENERGY STAR Lamps 2.0 Update Sept 2016

A-Lamps: 85% are Dimmable



A-Lamp Lifetime





ENERGY STAR Lamps Version 2.1 Revision 2017

- Considerations:
 - New allowable variation: LED
 - Directional Lamp lifetime
 - ASSIST metric for assessing the direct perception of light source flicker
 - ANSI Driver Robustness Test
 - New CIE color metric
 - NEMA Temporal Lighting Artifacts (TLA) Standard
 - SSL7B
 - CFL measurement temperature range
- Estimated start Q1 2017
- Would not impact products already certified
- Additional testing would involve reporting results for EPA evaluation to help inform future requirements
- energystar.gov/lamps.



ENERGY STAR® LAMPS SPECIFICATION V2.0

The simple choice for energy efficiency.



April 2016

Key Updates

Higher Efficacy Targets

- The current lighting market presents an opportunity for additional efficiency gains, which can be made by raising efficacy levels for all lamps—without sacrificing performance or cost.
- Reported values for each lamp model shall meet the applicable requirement in the table below.

	Minimum Lamp Efficacy (initial lm/W)	
	CRI ≥ 90	CRI < 90
Omnidirectional	70	80
Directional	61	70
Decorative	65	



Broader Scope and Product Eligibility

- EPA expanded the scope of the specification to include connected functionality, color tunable lamps, additional socket types, and lamp shapes like the popular vintage filament style.
- A broader variety of high-quality lamps are now eligible for ENERGY STAR certification.



Key Benefits

- ▶ Greater energy savings.
- ▶ Expanded choices for consumers; connected, color tunable, and vintage filament style LED, as well as greater flexibility for lower-cost high-quality LED bulbs.

New Lifetime Requirements

- The minimum lifetime L70 requirement for omnidirectional and decorative lamps is 15,000 hours, while the minimum requirement for directional lamps is 25,000 hours.

Improved Harmonization between ENERGY STAR Lighting Specifications

- EPA aligned the lamp specification with the ENERGY STAR Luminaires V2.0 specification in several key areas, including: color rendering, start time, and run-up time.

Timeline

- Effective immediately, manufacturers can certify eligible products to Lamps V2.0. After July 1, 2016, certification bodies will no longer certify to version 1.1. Any lamp manufactured as of January 2, 2017 must be certified to V2.0 to bear the ENERGY STAR mark.

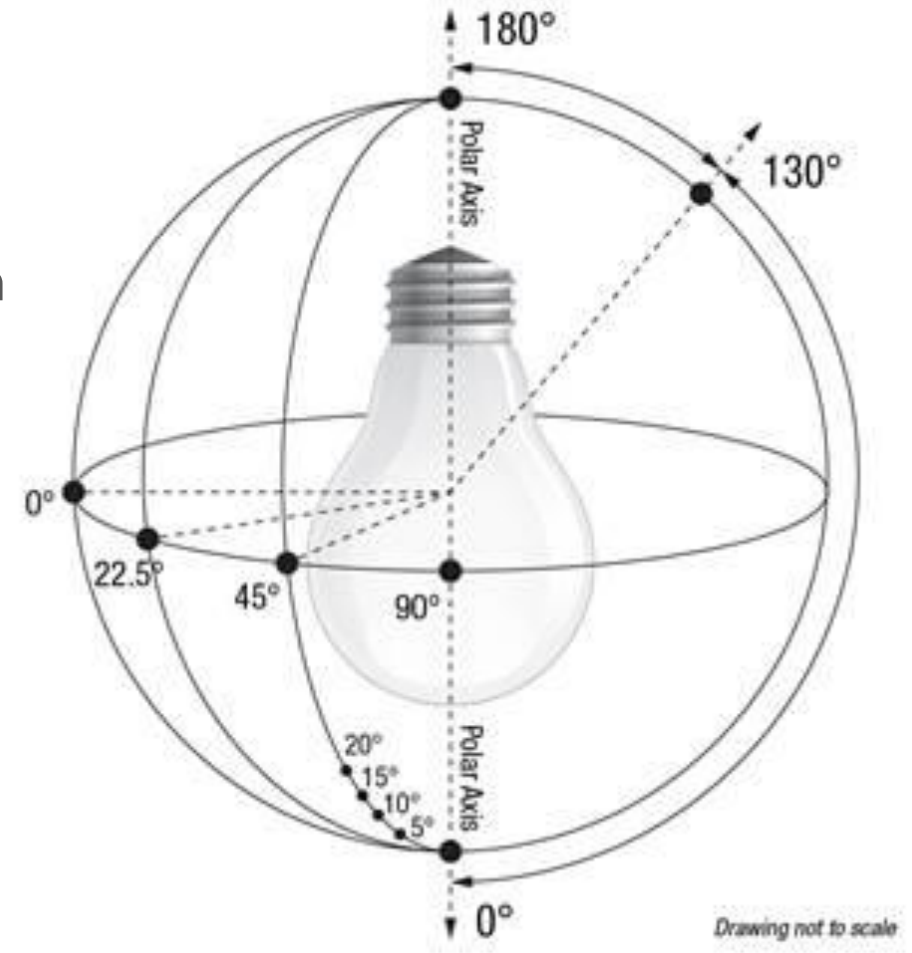
Alignment with DOE Pending Test Method for LED

- EPA references the upcoming DOE Test Procedures for CFL and LED lamps. That means upon their finalization, these test procedures can be used for ENERGY STAR certification.
- For consistency, EPA aligned reported performance figures with DOE and FTC for all lamps, including those not covered by the current regulation.

Resources: For more information, visit: energystar.gov/lamps or contact: lighting@energystar.gov.

Calculator & Certification Tool Updates

- TM-21 Calculator updates
- New TM-28 Calculator
- New calculators for omni and deco lamp distribution
- ENERGY STAR Requirements for Using LM-80: [comments due November 18, 2016](#)





ENERGY STAR Lighting Webinar Series

Understanding and Addressing Flicker

February 25, 2016



Dr. James Gaines

Senior Principal Engineer, Philips Lighting

“Temporal Light Artifacts (Flicker + Stroboscopic Effect)”



Dr. John Bullough

Director of Transportation and Safety Lighting Programs,
Lighting Research Center

“Indirect Flicker Perception: Stroboscopic Effects from Light Source Flicker”

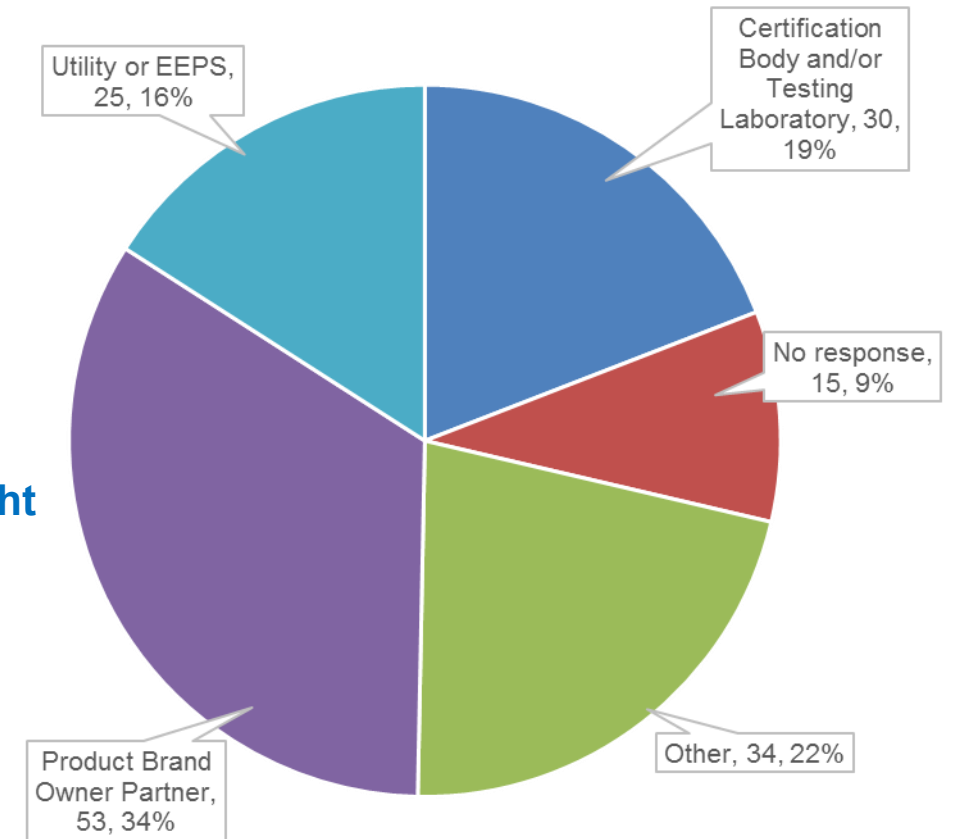


Andrew Bierman

Senior Research Scientist, Lighting Research Center

“Quantifying the Detection of Directly Perceived Flicker”

218 Stakeholders Attended



Evaluating Color Quality

March 31, 2016

189 Attendees



Jean Paul Freyssinier

Senior Research Scientist, Lighting Research Center

“Communicating Light Source Color Properties for General Illumination” Class A Color”



Dr. Michael Royer

Lighting Engineer, Pacific Northwest National Laboratory (PNNL)

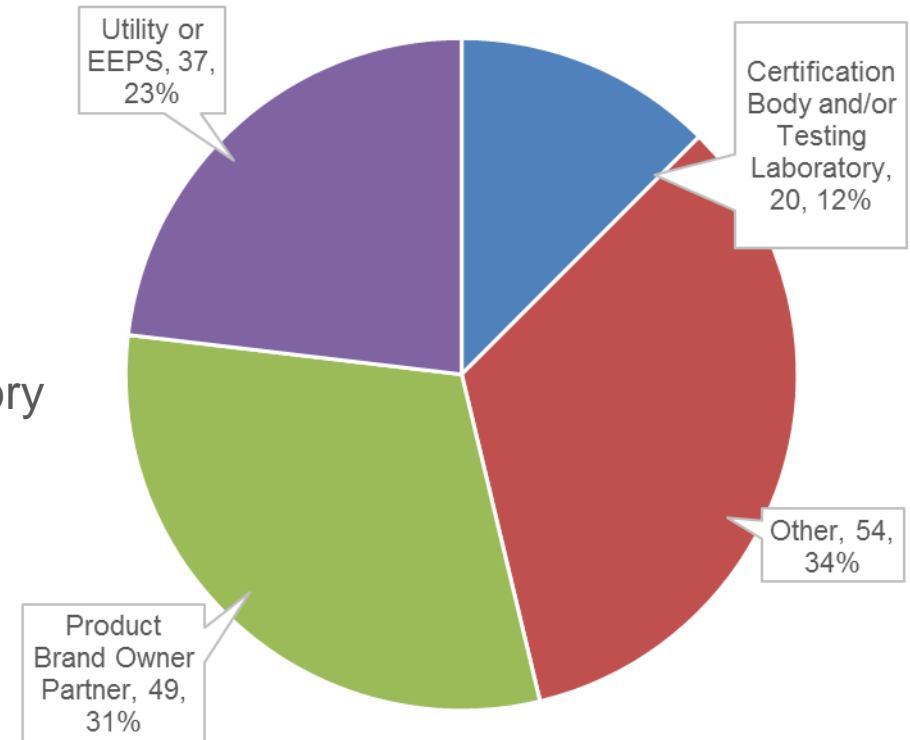
“Evaluating Color Rendering with TM-30”



Dr. Yoshi Ohno

NIST Fellow, Sensor Science Division
(President, International Commission on Illumination)
National Institute of Standards and Technology (NIST)

“Color Quality of Lighting and Metrics – Where are we going to?”



Latest Trends in Connected Lighting

May 26, 2016



Tom Hamilton

Vice President of Marketing, Ketra
“Connected Lighting”



Amanda Parrilli

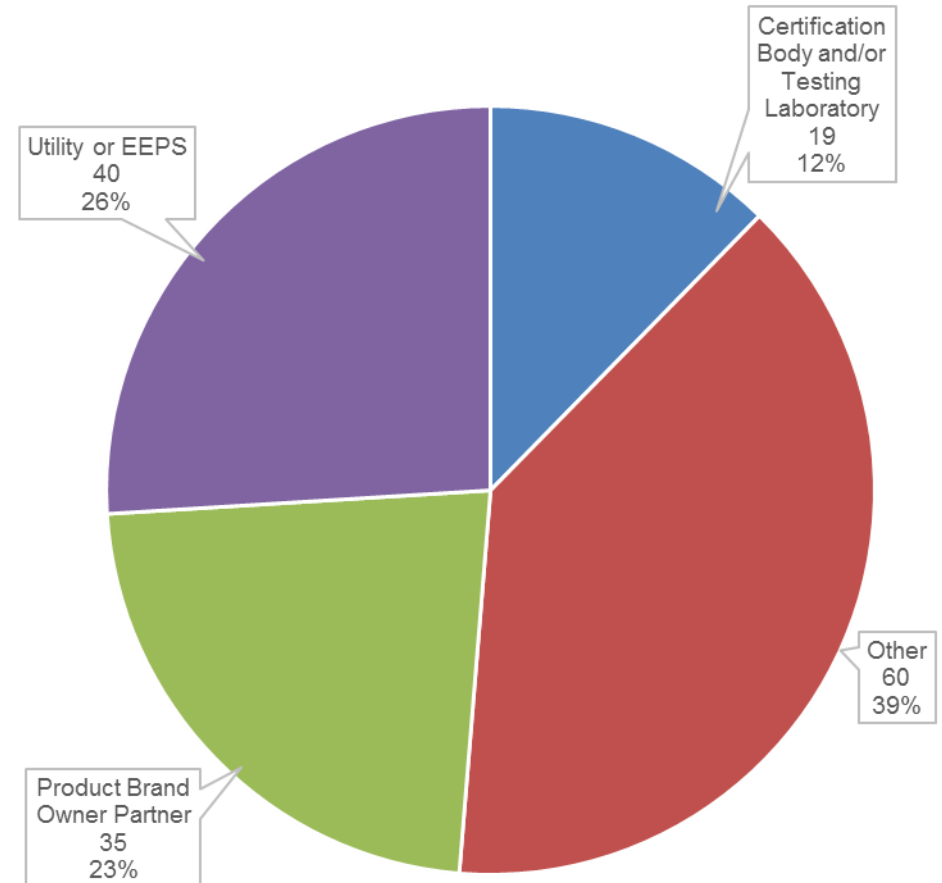
Director of Strategic Development, The Home Depot
“Connected Lighting”



Michael Poplawski

Senior Engineer, Pacific Northwest National Laboratory (PNNL)
“Technology Keys for Connected Lighting”

188 Attendees





Follow-Up: Understanding and Addressing Flicker

June 30, 2016



Alex McEachern

Fellow, IEEE and Convenor, IEC, Power Standards Lab

“Flicker: Electric Power Perspective On the World”



John McHugh

McHugh Energy Consultants Inc.

“Measuring Flicker: California’s JA10 Test Method and Its Uses”

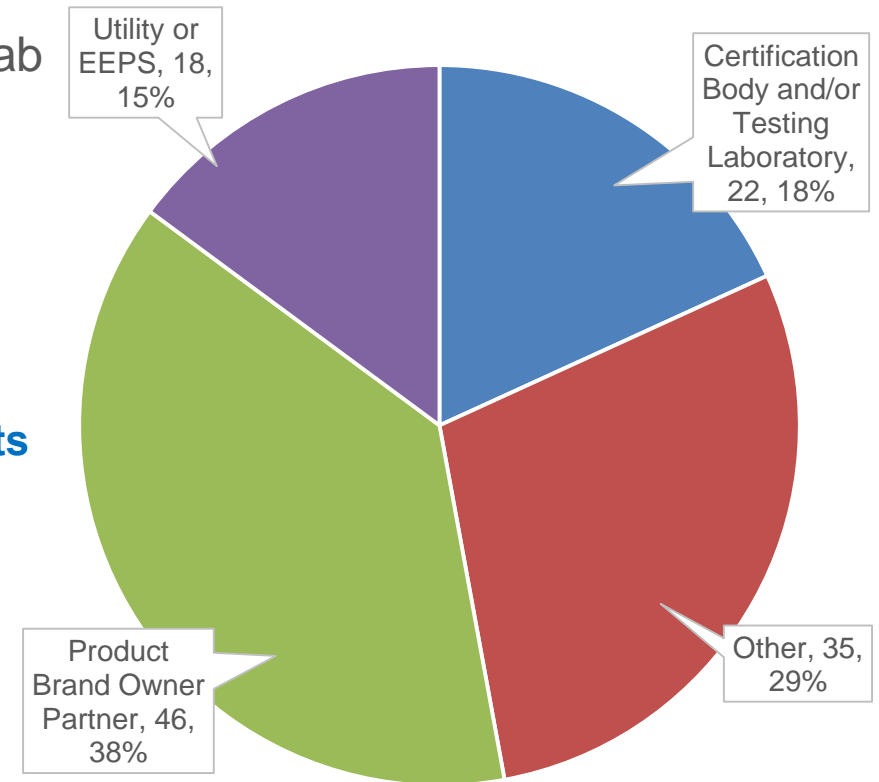


Andrew Bierman

Senior Research Scientist, Lighting Research Center

“Measuring and Assessing Light Source Flicker”

131 Attendees



Follow-Up: Evaluating Color Quality

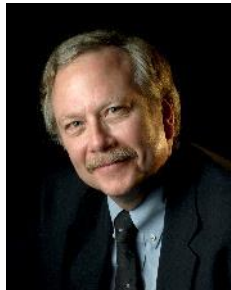
July 28, 2016



Mark Lien

Industry Relations Manager, Illuminating Engineering Society

“How do we know what won’t disappoint?”



Dr. Mark S. Rea

Director of the Lighting Research Center (LRC) and Professor of Architecture and Cognitive Sciences, Rensselaer Polytechnic Institute

“Evaluating Color Quality (Part 2): Food For Thought”



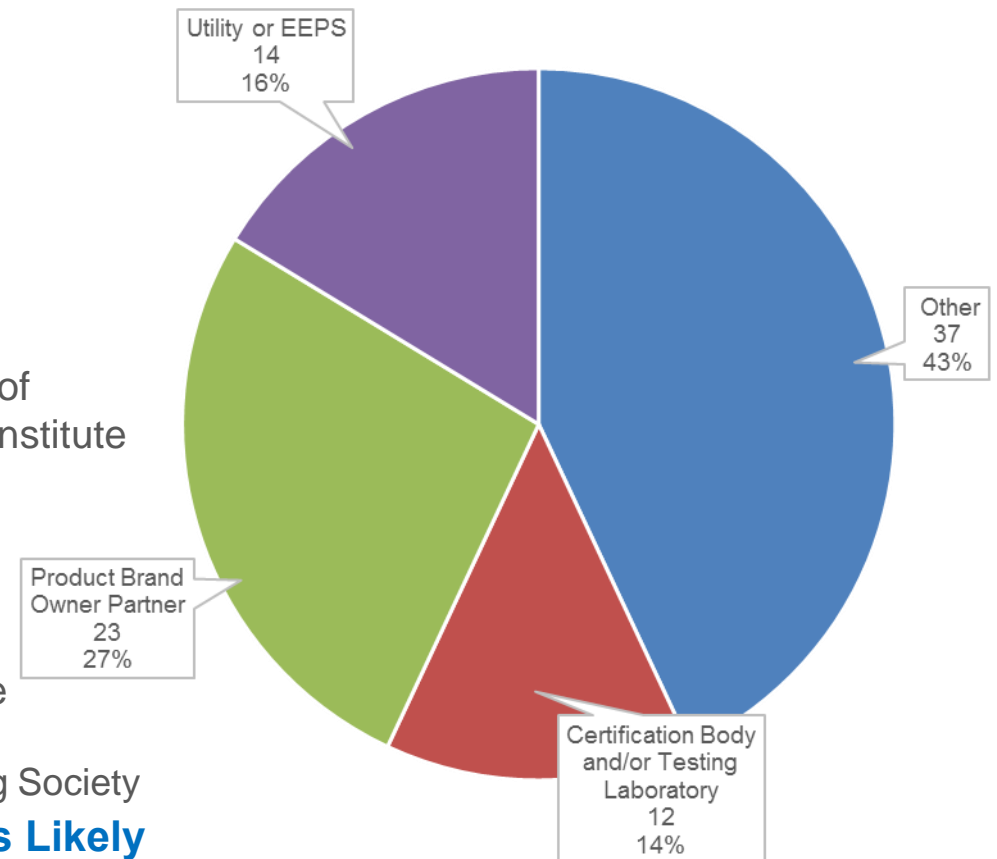
Dr. Kevin W. Houser

Professor of Architectural Engineering, The Pennsylvania State University

Editor-in-Chief, LEUKOS, the journal of the Illuminating Engineering Society

“Color Preference: What Light Source Spectra are Less Likely to Disappoint?”

88 Attendees



The State of Dimmable LED Lamps



Ethan Biery

Design and Development Leader, Lutron Electronics

“Improving phase-control dimming of LEDs”

August 25, 2016



Tom Stimac

Chief Innovation Manager, GE Lighting

“The State of Dimmable LED Lamps”

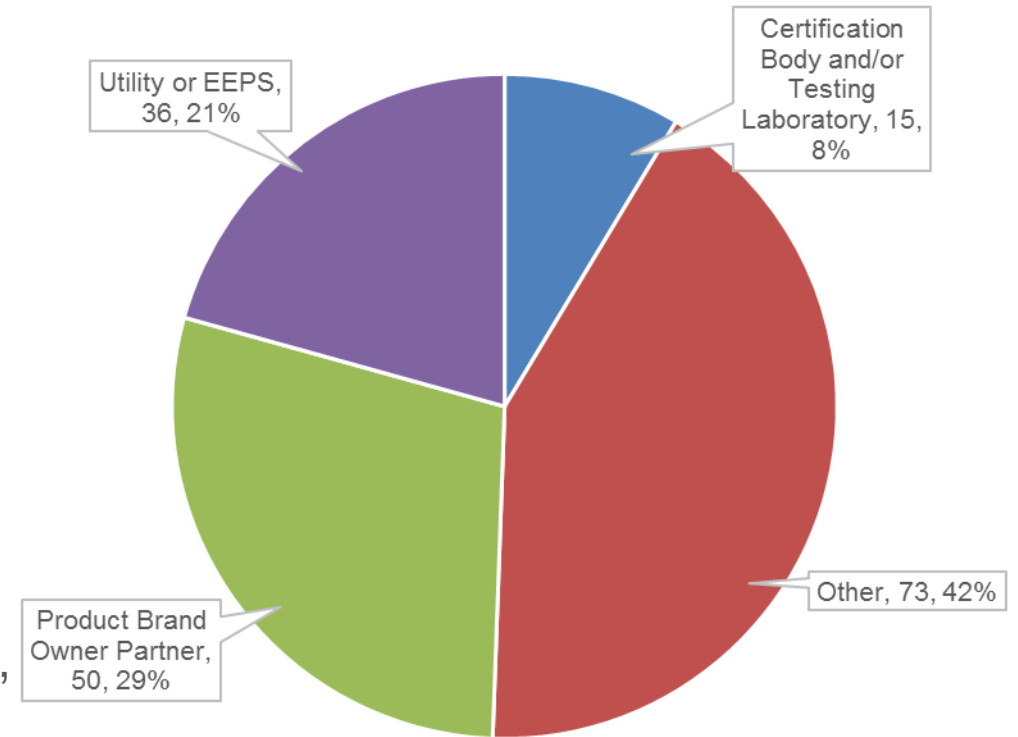


Jennifer Dolin

Manager of Sustainability and Environmental Affairs,
LEDVANCE Corp (formerly OSRAM SYLVANIA)

“NEMA SSL7A Marketing Guidelines Project Update”

196 Attendees



The Quest for a Short Term Reliability Test

September 29, 2016

107 Attendees



Nadarajah Narendran

Director of Research, Lighting Research Center (LRC)

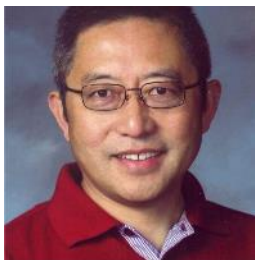
“A Short-Duration LED System Life Test”



Mike Ting

Senior Principal Energy Consultant, Itron

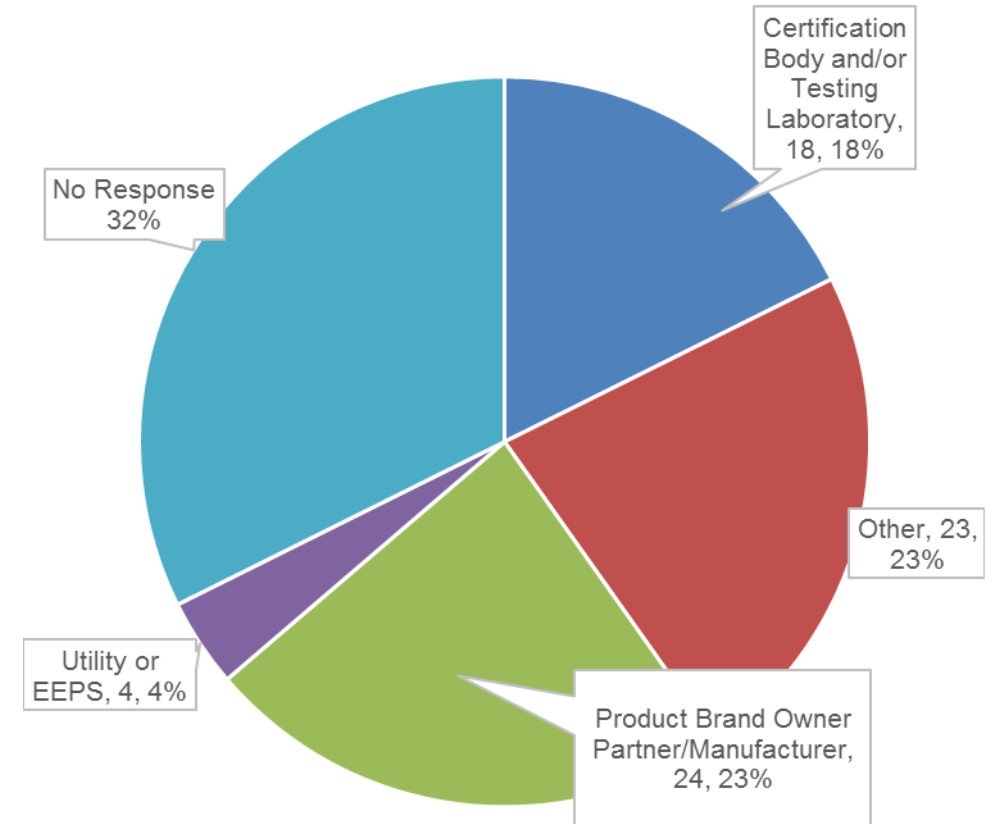
“CPUC LEDs in Real Fixtures Test Study Update”



Dr. Jianzhong Jiao

JZJ Consulting

“Short-Term Reliability Tests – Standards Development”





Follow-Up Webinar: Latest Trends in Connected Lighting

December 29, 2016 from 1:00PM - 3:00PM EDT

This follow up webinar will cover the rapidly changing market for connected lighting. During this webinar, we will discuss the market for residential connected lighting and any considerations for utility programs. We will explore the performance and presence of ENERGY STAR certified connected lighting products in the market.



Lara Bonn

Efficient Products Strategy & Planning Manager

Efficiency Vermont



Philip Smallwood

Director of LED & Lighting Research

Strategies Unlimited



ENERGY STAR Lighting Verification Testing Update

Overview of results to date





CFL Verification Testing Recap

- Program History:
 - **2010 - 2014:** Verification testing conducted annually for 20% of CFLs under the ENERGY STAR CFL Third Party Verification Testing Program
 - **2012:** Results show failure rates that were higher than average than other ENERGY STAR product categories
 - **May 2013:** EPA publishes OEM Performance Assessment, which outlines test results and performance trends from the CFL testing program. Key findings include:
 - There is significant testing performance variability among CFL OEMs
 - Consistent production of high-performing products is achievable
 - EPA can address quality control issues through enhanced compliance monitoring efforts
 - **December 2013:** EPA launches CFL Heightened Oversight program

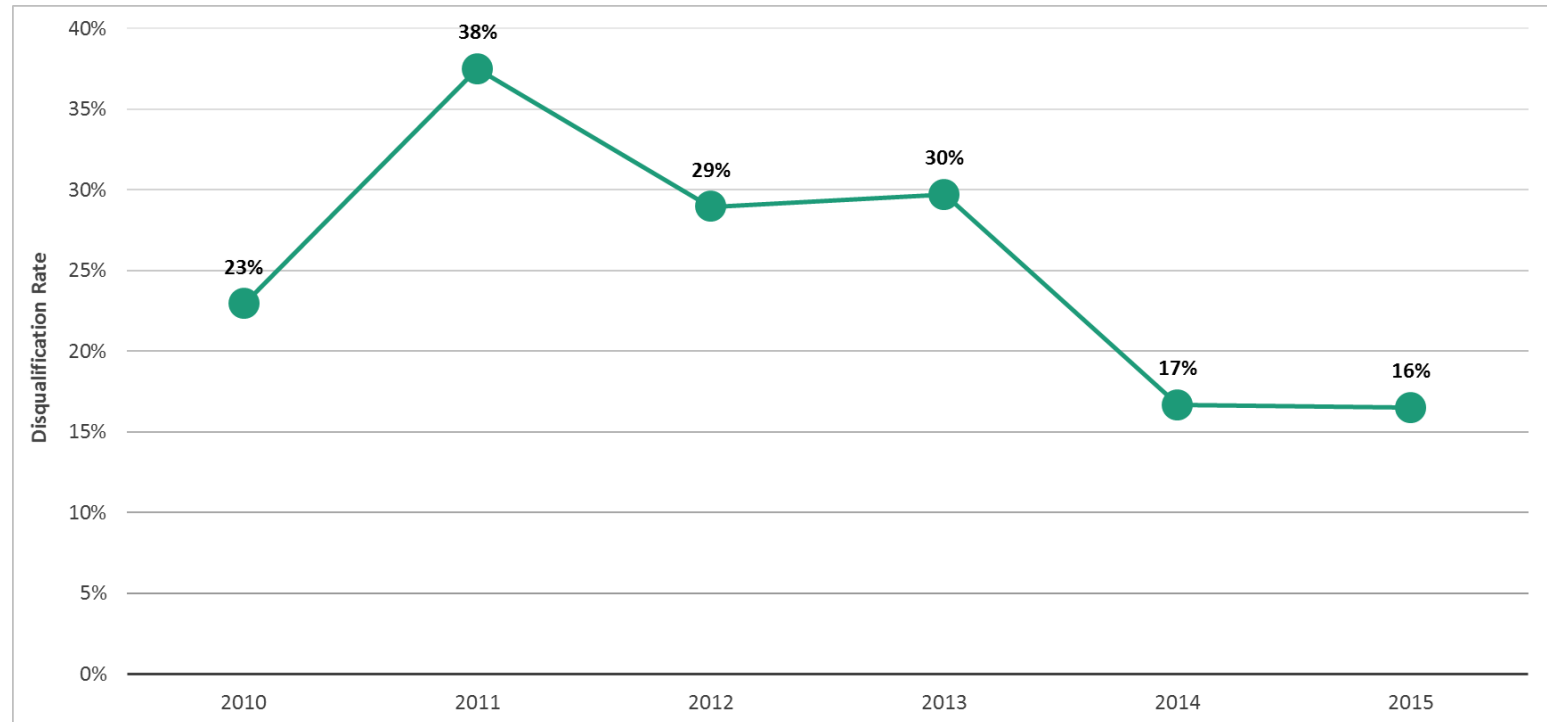


CFL Verification Testing Update

- 550 CFLs tested (2010-2015)
- 3 Years of Heightened Oversight



ENERGY STAR CFL Verification Testing Disqualification Rates 2010-2015



CFL Heightened Oversight Program Overview

Compliance Rate Monitoring and Communication

- **Objective:** Ensure that CFL OEMs that supply products associated with the ENERGY STAR label are aware of their testing performance
- **Description:**
 - EPA issues annual individualized letters to CFL OEMs that provide recaps of verification testing performance

CFL Heightened Oversight Program Overview

Heightened Quality Assurance Oversight

- **Objective:** Enhanced oversight of products from sources with demonstrated quality assurance vulnerabilities
- **Description:**
 - Labelers of CFLs that fail verification testing are subject to heightened control measures if the failed product is sourced from an OEM with below average performance
 - Labelers required to submit additional documentation of quality assurances covering models from source

CFL Heightened Oversight Program Overview

Increased Source-based Testing

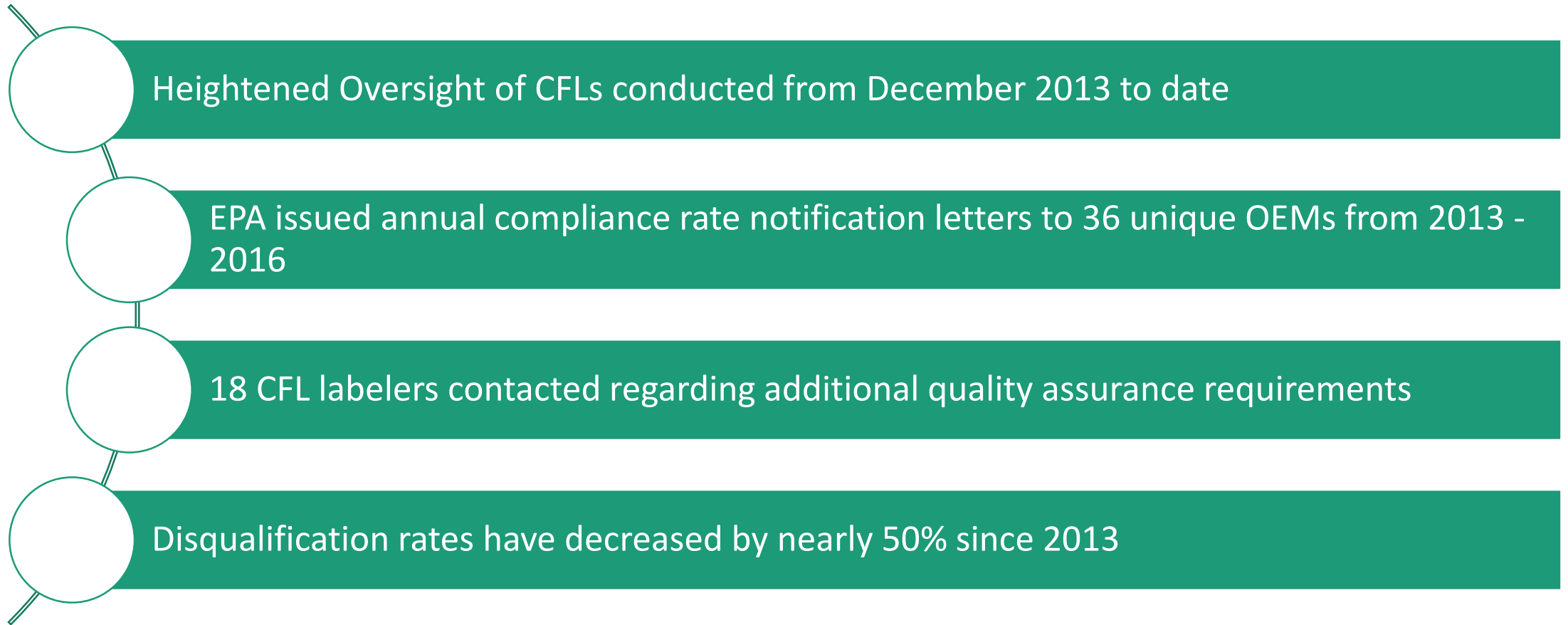
- **Objective:** Enhanced testing of OEMs with history of below-average performance or limited verification testing exposure
- **Description:**
 - CFL models sourced from OEMs with history of below-average performance given greater consideration for verification testing nominations
 - CFL models sourced from OEMs with few products tested in CFL testing program sought for additional testing

CFL Heightened Oversight Program Overview

Product Control Measures

- **Objective:** Minimize the impact of disqualified CFLs on consumers
- **Description:**
 - Continued requirement of corporate certification detailing measures undertaken to manage distribution of disqualified models

CFL Heightened Oversight Program Results



Luminaires Verification Testing Update

Testing from 2013-June 2016

- 674 Luminaires tested
- From 2013-2016
 - 56 disqualified



Failing most frequently

- Efficacy
- Max driver temperature
- Ballast temperature
- Color angular uniformity
- Start time
- Lumen maintenance
- CCT



ENERGY STAR LED Lamp Verification Testing Update

Summary to Date

- 440+ LED lamps subjected to VT from 2013 to date
 - 201 Completed 239 Ongoing (2016 testing)
 - 48 lamps failed one or more requirements
 - 31 lamps failed only one requirement
 - 14 lamps failed two requirements
 - 3 lamps failed more than two requirements
- 77 partners had products tested
 - Failures cut across 31 partners (22 OEMs)
 - >60% partners had no failures
 - 0 lamps failed efficacy
 - 0 lamps failed rapid cycle stress testing

What requirements are lamps failing to meet?

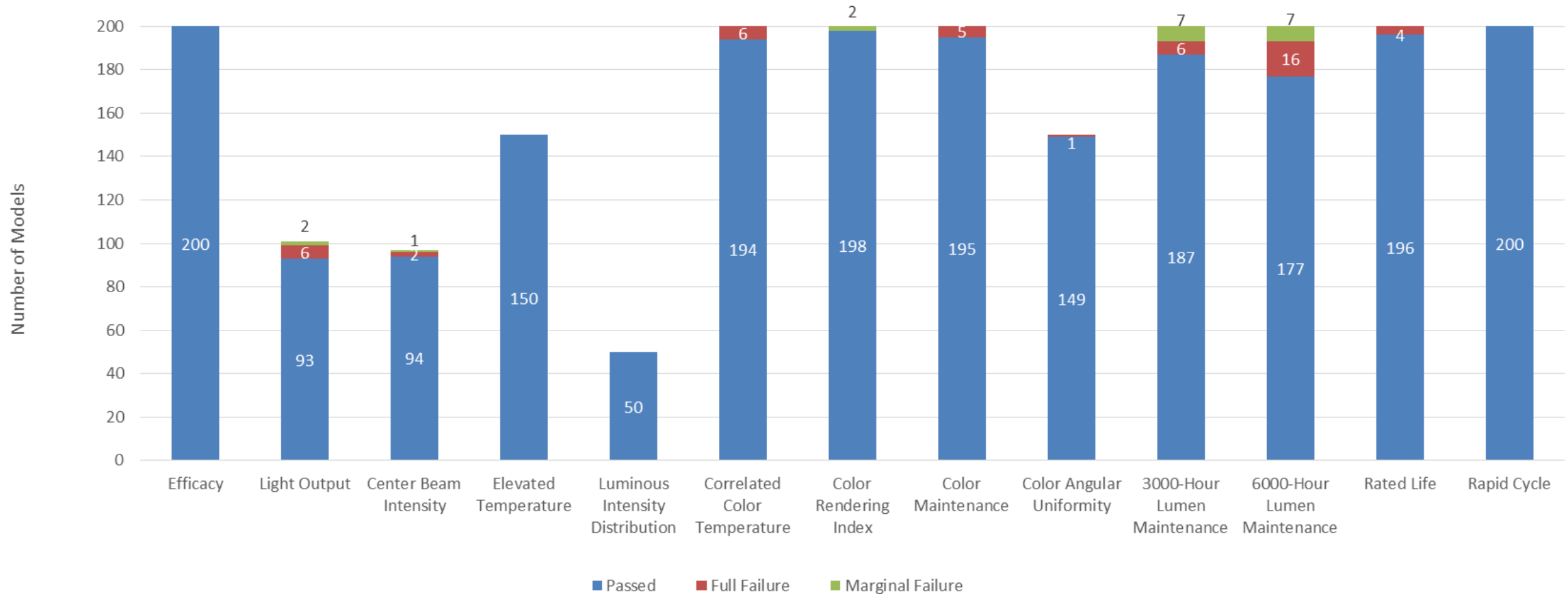
- 2014-2015
 - Lumen maintenance
 - Failure to meet equivalency claims
 - Light output or Center beam intensity
- 2016 failures so far
 - Luminous intensity distribution
 - Center beam intensity
 - Exceeding ANSI Lamp dimensions





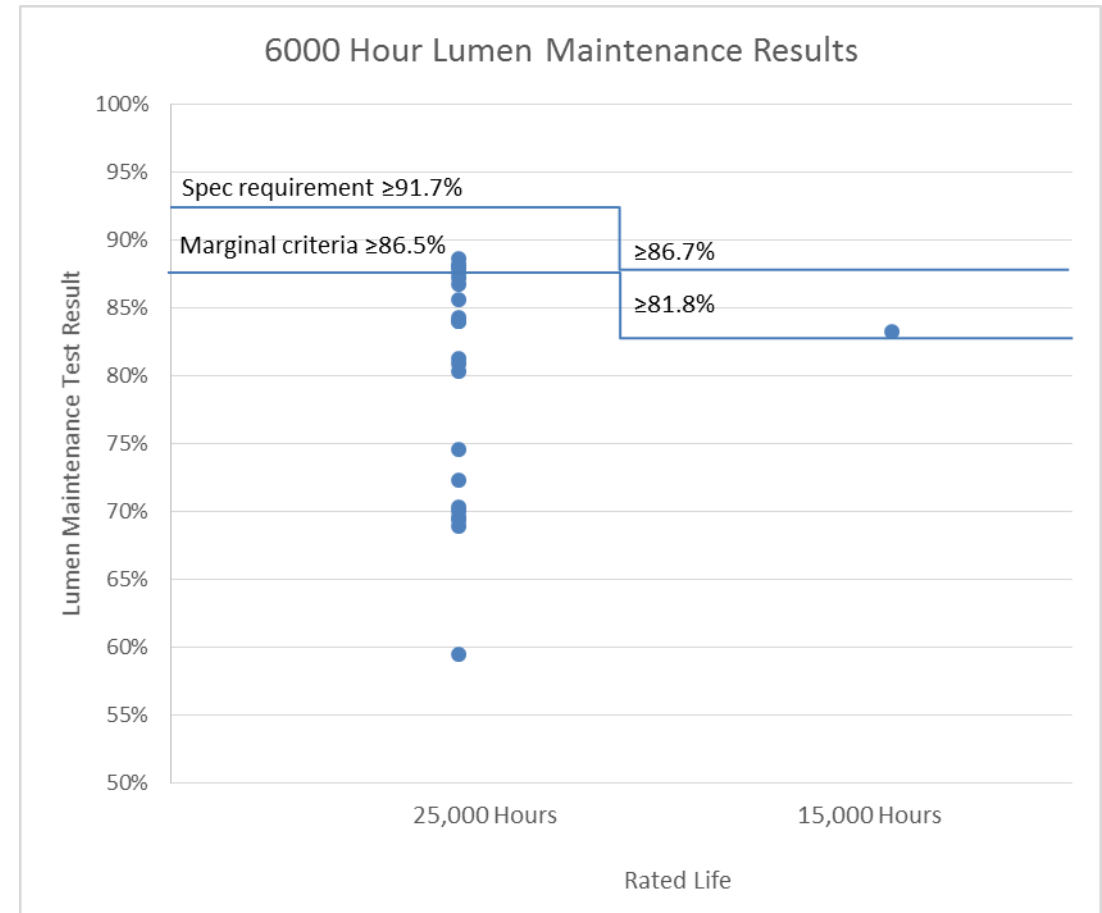
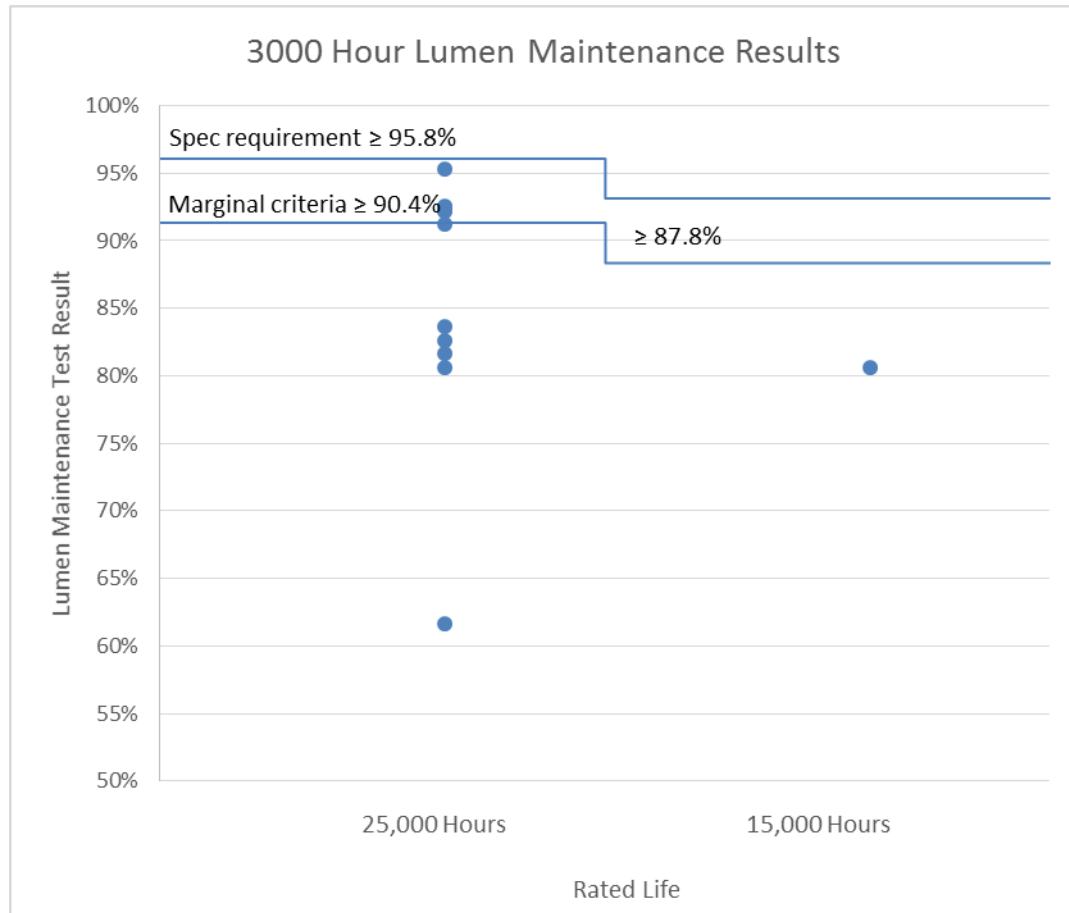
ENERGY STAR LED Lamp Verification Testing Failures by Requirement

Summary Results by Test: All Lamp Types



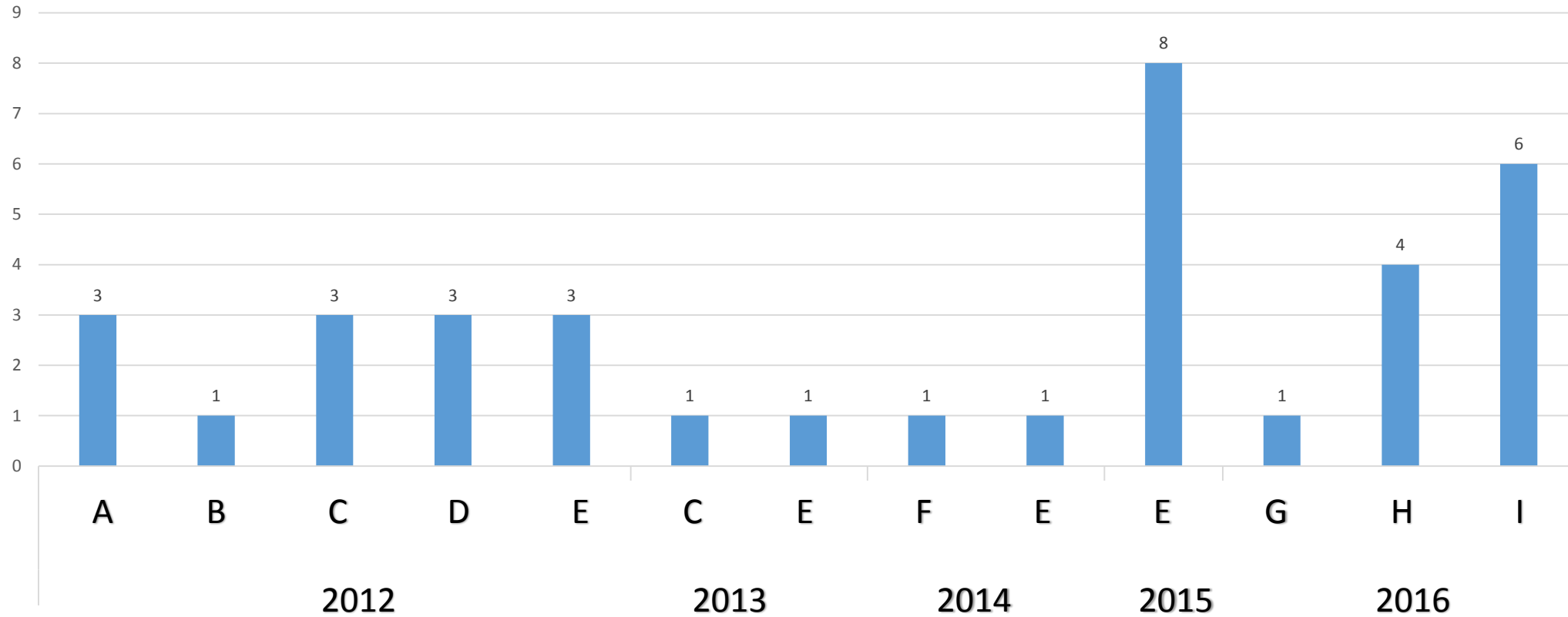


ENERGY STAR LED Lamp Verification Testing Failures by Requirement





Early Certification Lifetime Testing Failures per OEM, by year





Other Lighting Initiatives & Plans for 2017

- Dimming research
- Flicker work & test methods
- Scoping residential controls
- Continuation of technical webinar series?
- Connected home future cross product webinar series?



Thank you!