Luminaires V2.0 Draft 2 Webinar

March 17, 2015
2:00pm-5:00pm EST

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Today's Agenda

Introduction

- Introductions
- Specification Process
- Goals

Draft 2 Changes

- Definitions
- Testing
- Photometric Performance
  - Efficacy
  - Color
- Packaging

Wrap Up

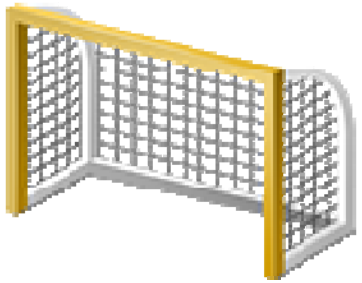
- Timeline
- Questions / Discussion

Welcome!

- Introductions
  - In Person
  - Remote / Call-In
- Questions / Comments are Welcome
  - For benefit of everyone, please state name prior to a comment
  - Can ask questions via the webinar at any time

Goals of the Specification Revision

- Goals
  - Streamline & Simplify
  - Increase Efficacy Levels
  - Adjust Scope and Increase Flexibility



Specification Development Process Overview

- Timeline
  - Draft 1:
    - Published December 18, 2014
    - Stakeholder Meeting January 21, 2015
  - Draft 2:
    - Released March 6, 2015
    - Stakeholder Meeting March 17, 2015
    - Comment period closes April 3, 2015
  - Next Draft:
    - Estimated release April 2015 & comment period (est. 2 weeks)
    - April 20th stakeholder meeting
  - Final Specification
    - Estimated release May 2015
  - Effective 9 months later (February 2016)

Section 4: Definitions

- Clarified several definitions:
- Connected Luminaires
  - An ENERGY STAR eligible luminaire or retrofit is a luminaire or retrofit which includes **elements or instructions required** to enable communication…
    - Instead of "…all elements (hardware, software)…"
- Enclosed Luminaire
  - Luminaire which contains enclosed lamp compartment(s) where ventilation openings are less than 3 square inches per lamp in the lamp compartment or where the cross-sectional area of the opening of the lamp compartment is less than the maximum cross sectional area of the lamp compartment (adapted from UL 1598).
- LED Light Engine
  - Removed the term "custom" describing connectors based on stakeholder feedback

Section 4: Definitions

- Clarified several definitions:
- Secondary Optics
  - Included “diffuser” in the examples of secondary optics based on stakeholder inquiry
- SSL Downlight Retrofits and SSL Surface Mount Retrofits
  - Included references to UL1598C
  - Excludes self-ballasted lamps
  - Excludes products utilizing the existing transformer or ballast

Section 5.1: NEW Testing Color Tunable

- Clarifications:
  - Noted that the **Least Efficient Setting** and **Most Consumptive Setting** need to be selected by the partner
  - Instructions must be provided for reaching these settings for repeatability

Section 5.2: NEW Certified Lighting Subcomponent Database

- NEW SECTION…
  - Not new material
- Describes how to:
  - List subcomponents
  - Reference / utilize subcomponents
- EPA Inquiry:
  - ANSI Standard for LED Drivers upcoming, is there usefulness to partners to have Drivers in the CSD?

Section 6.1: Product Families

- Minor updates
  - Correction to remove CBCP and CAU for the reflector/trim variation from Draft 1
- Listing of data
  - For consistency, products should be listed when there is a change in photometric performance.
    - E.g. a CCT change would have a separate line item as a variation in the product data exchange system, where a change in finish would not
- Sharing of lumen maintenance for different color renderings
  - EPA has received limited data to support this variation for LEDs (only)
  - More product level data is needed to include this variation

Section 7: Methods of Measurement & Reference Documents

- References added to:
  - For frequency:
    - IEEE P1789: IEEE Recommending Practices for Modulating Current in High Brightness LEDs for Mitigating Health Risks to Viewers
  - For SSL retrofits:
    - ANSI / UL 1598C: Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits

Organization	Identifier	
ANSI	C78.376-2001	Specifica
ANSI/NEMA/ ANSLG	C78.377-2011	Specifica
ANSI	C78.5-2003	Specifica
ANSI/ANSLG	C78.81-2010	Double-C
ANSI	C78.901-2014	Single-Ba
ANSI/ANSLG	C81.61-2009	Specifica
ANSI/ANSLG	C81.62-2009	Lamphold
ANSI	C82.11-2011	High-Freq
ANSI	C82.2-2002	Method o
ANSI	C82.77-2002	Harmonic
ANSI/IEEE	C62.41.1-2002	IEEE Gui
ANSI/IEEE	C62.41.2-2002	IEEE Rec
ANSI/UL	153-2002	Standard
ANSI/UL	935-2009	Standard
ANSI/UL	1310-2010	Standard

Section 8. Certification by Shipping Fixtures with ENERGY STAR Certified Lamps

- Stakeholder feedback:
  - Concerns over elevated temperatures in enclosed fixtures
  - Applicability to directional luminaires

Draft 2 Additions:

- Elevated temperature testing:
  - An enclosed luminaire may not ship with a lamp marked with the restriction "not for use in enclosed fixtures" or similar.
  - In situ testing of the ambient air temperature inside the fixture with the lamp(s) installed.
  - Can not exceed the lamp manufacturer's recommended operating temperature range, and/or 45°C

Questions??

- Questions about previous section?

Section 9.1 Luminous Efficacy

- Future Tier proposed:
  - **+20%** required efficacy level 2 years **after the effective date** of the specification
    - 2018
- From
  - **65-90 lm/W**

    to
  - **78-108 lm/W**

US DOE Projections of Efficacy – Multi Year Program Plan

TABLE 3.10 BREAKDOWN OF WARM-WHITE[1] LED LUMINAIRE EFFICIENCY PROJECTIONS

Efficiency Channel	2013	2015	2020	Goal
Package Efficacy Projection[2] (lm/W)	135	169	225	250
Thermal Efficiency (increased T_{op})	86%	88%	93%	95%
Driver Efficiency	85%	87%	93%	96%
Fixture/Optical Efficiency	85%	89%	94%	96%
Electrical Efficiency (reduced I_{op})	115%	113%	109%	105%
Overall Luminaire Efficiency	71%	77%	89%	92%
Luminaire Efficacy[3] (lm/W)	96	130	200	230

DOE Multi Year Program Plan can be accessed here.

US DOE Projections of Efficacy – Energy Savings Forecast of SSL in General Illumination Applications

Table E.6 Average LED Lamp and Luminaire Efficacy Projections by Sector and Submarket

Sector Submarkets	LED Lamp Efficacy				LED Luminaire Efficacy			
	2013	2015	2020	2030	2013	2015	2020	2030
Commercial								
General Service	70	81	102	131	-	-	-	-
Directional	62	72	91	117	57	66	82	113
Small Directional (MR16)	58	66	81	103	57	66	82	113
General Service Linear Fixtures	86	91	109	132	98	106	131	181
Low/High Bay	-	-	-	-	95	101	121	160
Other	62	72	91	117	98	106	131	181
Residential								
General Service	70	81	102	131	-	-	-	-
Decorative	58	73	100	148	-	-	-	-
Directional	62	72	91	117	57	66	82	113
Small Directional (MR16)	58	66	81	103	57	66	82	113
General Service Linear Fixtures	86	91	109	132	98	106	131	181
Other	70	81	102	131	57	66	82	113

DOE Multi Year Program Plan can be accessed here.

Section 9.1 Source Efficacy: Non-Directional

- Maintained levels from Draft 1
  - Fluorescent and LED Light Engines with Optics
    - 65 lm/W - Initial
    - 78 lm/W - 2 years after effective date
  - LED Light Engines without Optics
    - 90 lm/W – Initial
    - 108 lm/W - 2 years after effective date

Section 9.1 Source Efficacy: Non-Directional: SSL Surface Mount Retrofits

- Adjusted Efficacy based on stakeholder feedback:
  - Initial Efficacy Requirements
    - With Optics from 80 to 65 lm/W
    - Without Optic from 100 to 90 lm/W
- Adjusted to align with LED light engines, as the products share many similarities.

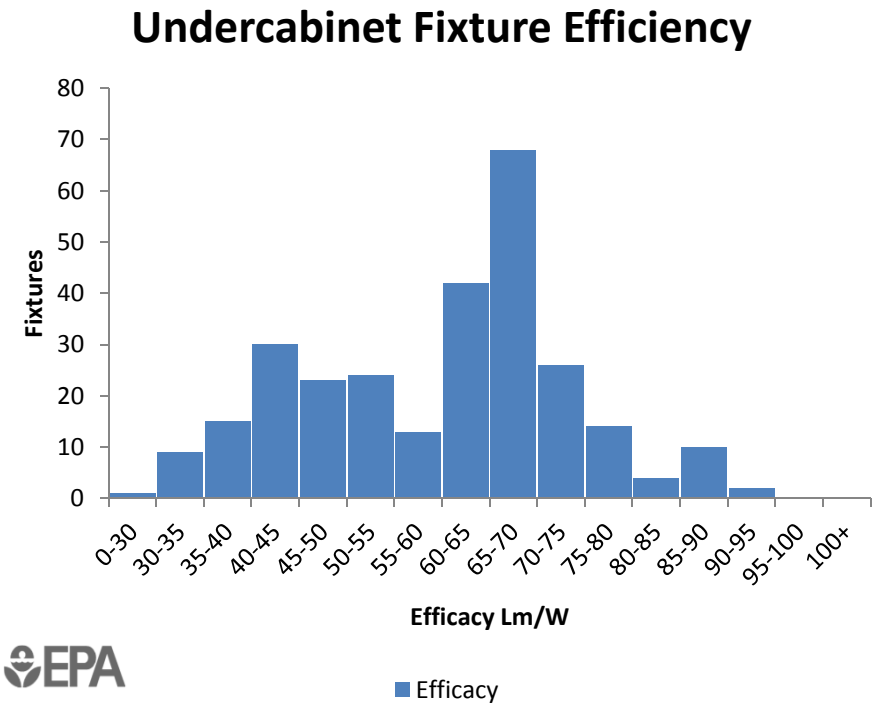
Section 9.2 Luminaire Efficacy: Directional

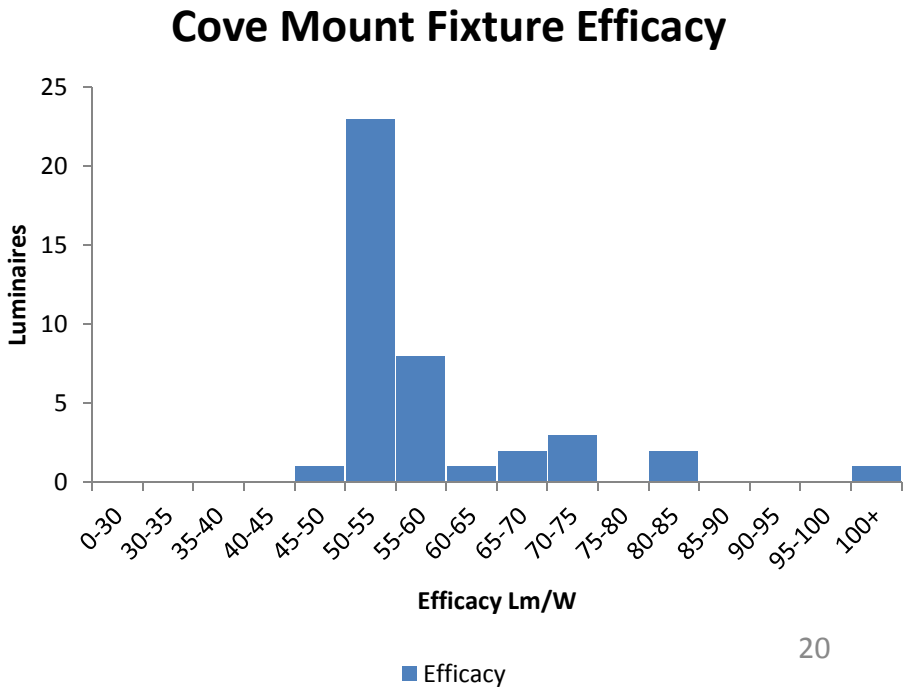
- Future Tier proposed:
  - **+20%** required efficacy level **2 years after the effective date** of the specification
- From
  - **50-90 lm/W**

    to
  - **60-108 lm/W**

Section 9.2 Efficacy: Directional Cove & Undercabinet

- Cove – maintained at Draft 1 level 55 lm/W
- Undercabinet – Adjusted to 55 lm/W from Draft 1 level 60 lm/W
  - Tier increase to 66 lm/W - 2 years after effective date



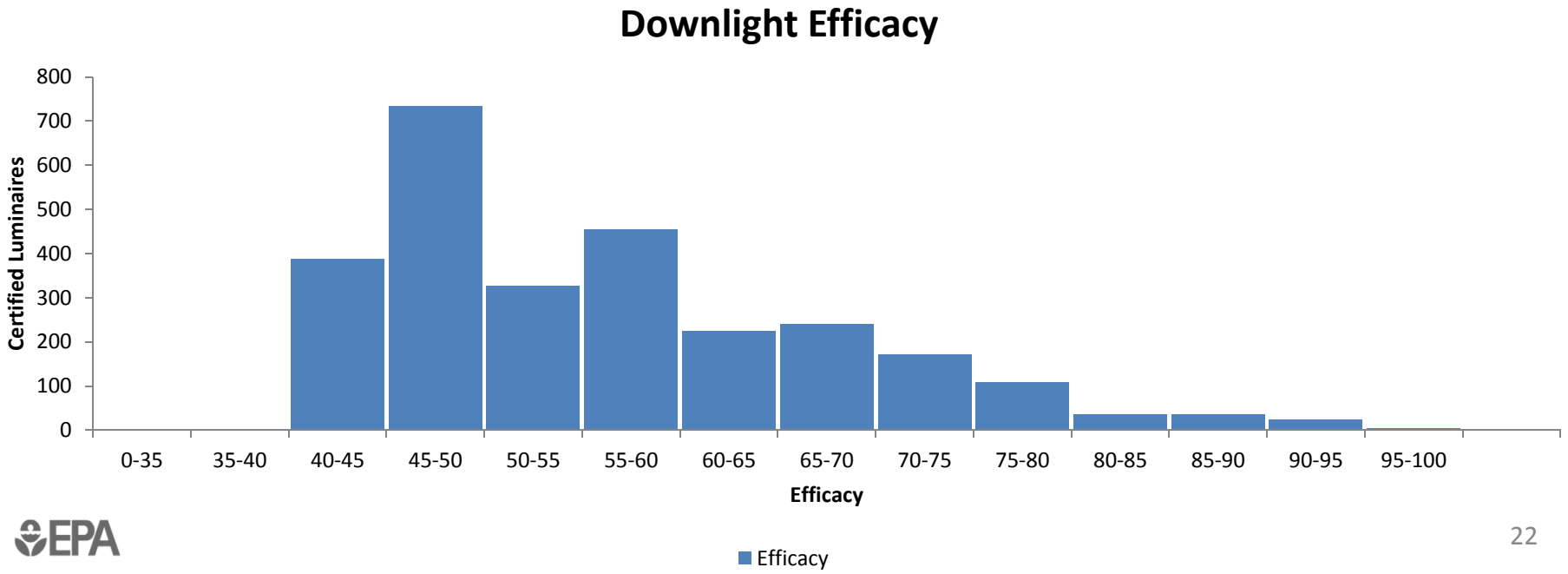


Section 9.2 Efficacy: Directional Cove & Undercabinet

- EPA will consider proposals for additional beam distribution but none have been received to date (e.g. symmetrical beam)
- Additional guidance regarding beam pattern evaluation provided:
  - When evaluating an asymmetrical distribution, the luminous intensity distribution from the goniophotometer scan is to be used in determining if the luminaire meets the requirement, as the Zonal Lumen Density chart is not typically sufficient to determine compliance of asymmetrical patterns.
- Zonal lumen density shows symmetrical data
  - An IES road report or similar should show the forward / backwards ranges.

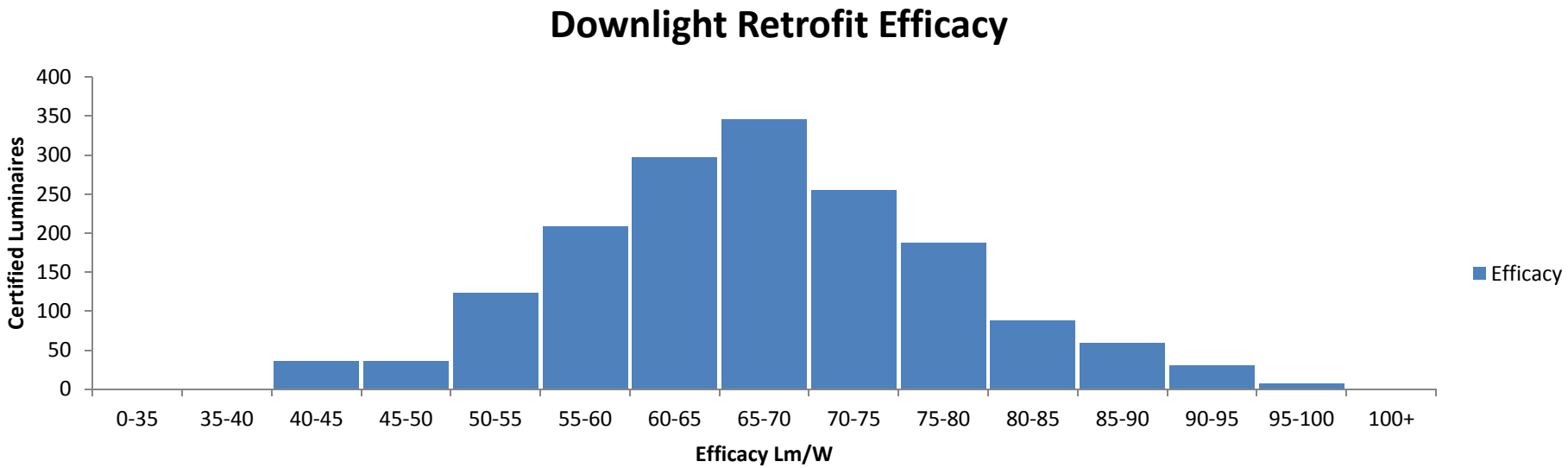
Section 9.2 Efficacy: Downlights

- Largest category of certified products
- Maintained 60 lm/W level from Draft 1
  - Future tier level 72 lm/W - 2 years after effective date



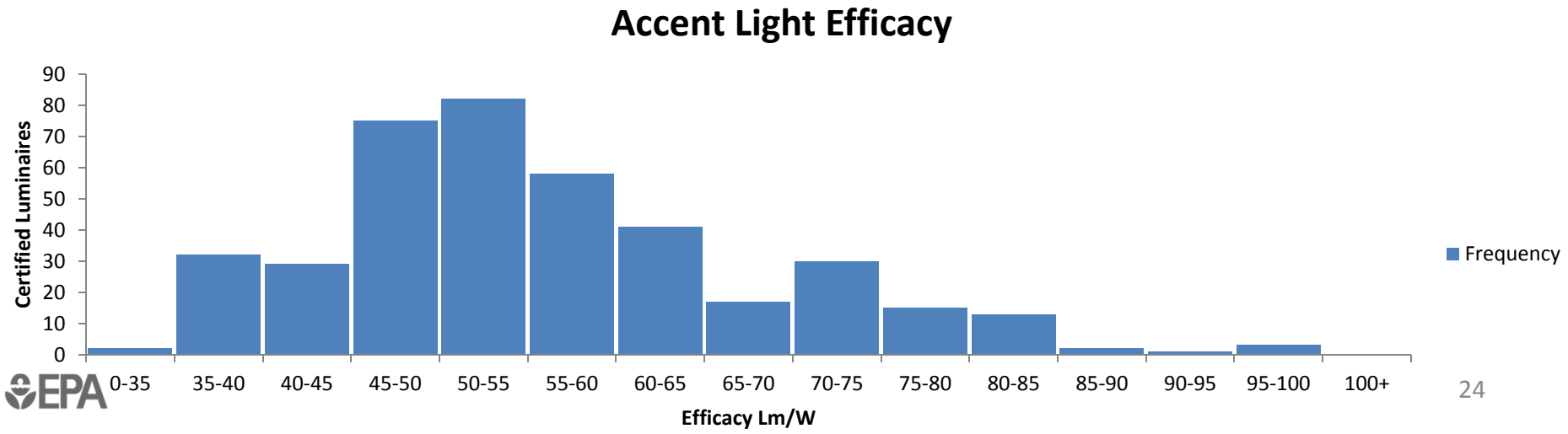
Section 9.2 Efficacy: Downlight Retrofits

- Adjusted to 65 lm/W from Draft 1 level of 70 lm/W
- Data suggests retrofits performing better than Downlights
  - Feedback suggests this is related to product design



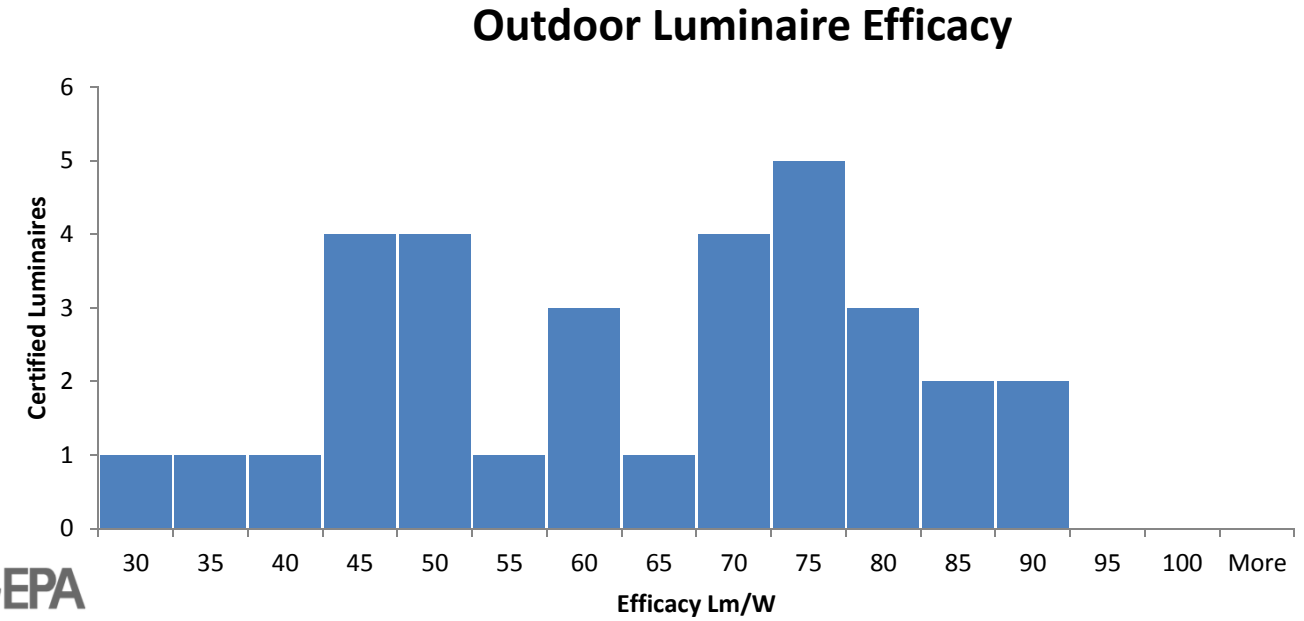
Section 9.2 Efficacy: Accent Lights

- Adjusted efficacy to 55 lm/W from Draft 1 level of 60 lm/W
  - 66 lm/W efficacy 2 years from effective date
- No proposals for alternative beam patterns received.



Section 9.2 Efficacy: Directional Outdoor

- No change from Draft 1 level - 60lm/W
  - 72 lm/W - 2 years from effective date
- Based on feedback from stakeholders, outdoor will not be limited to directional luminaires.
  - Porch, Ceiling, and Pendant Mount outdoor can be non-directional

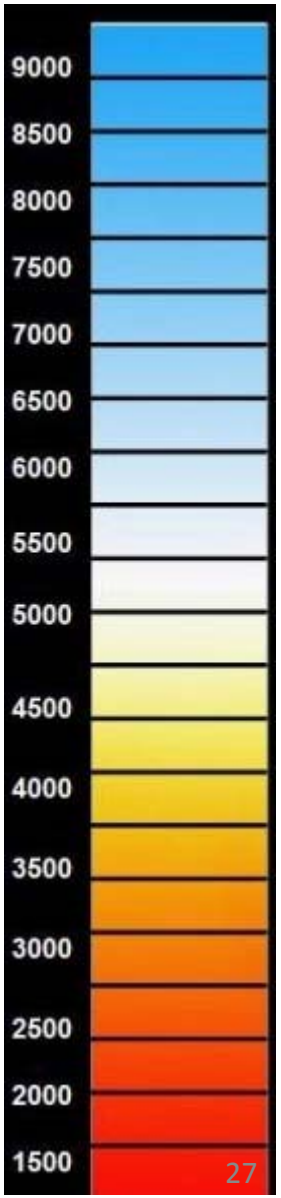


Section 9.2 Efficacy: Directional: Desk Lamps

- No change from Draft 1 level - 50 lm/W
  - Future Tier 60 lm/W 2 years after effective date

Section 9.3: Correlated Color Temperature

- Sample size for SSL reduced to 1
- Additional CCTs under consideration once ANSI C78.377 includes them:
  - 2200K
  - 2500K



Sections 9.4 Color Rendering

- CRI
  - Reduced sample size to 1 luminaire for SSL

Section 10: Lumen and Color Maintenance

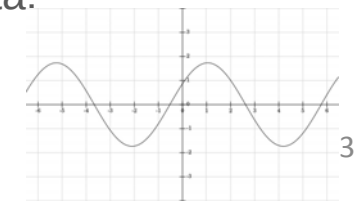
- Lumen Maintenance
  - Added TM-21 Calculator as a reference.
- Color Maintenance
  - Change in evaluation, not in testing
  - Evaluating all measured points for color maintenance, not just the 6,000 hour point
    - Shifting color beyond 0.007 is just as bad if it comes before or after 6,000 hours

Section 11.2: Run Up Time

- Added language to be consistent with Lamps, clarifying that the run-up time is to be taken after the seasoning.

Section 11.6: Operating Frequency

- Added guidance for measuring frequency, including photodetector, measurement interval, and measurement length.
- Will assist in monitoring and evaluating future performance
  - Laboratory test results shall be produced using the specific luminaire, or LED light engine used in the luminaire. Light output waveform shall be measured with a photodetector with a rise time of 10 microseconds or less, transimpedance amplifier and oscilloscope. Employed equipment models and method of measurement shall be documented. Temporal response, amplification and filtering characteristics of the system shall be suitably designed to capture the photometric waveform. Digitized photometric waveform data and an image of the relative photometric amplitude waveform shall be recorded. Measured data shall be recorded to a digital file with an interval between each measurement no greater than 0.00005 sec (50 microseconds) corresponding to an equipment measurement rate of no less than 20kHz, and capture at least 1 second of data.



Section 13: Thermal Performance: Case Temperature & Downlights

- Testing should be under worst case thermal situation product is rated for
  - Clarifies airtight and insulation contact cans (additional marketing guidance now appears in packaging requirements)
  - Requires the temperature measurement to be taken with retrofits in situ

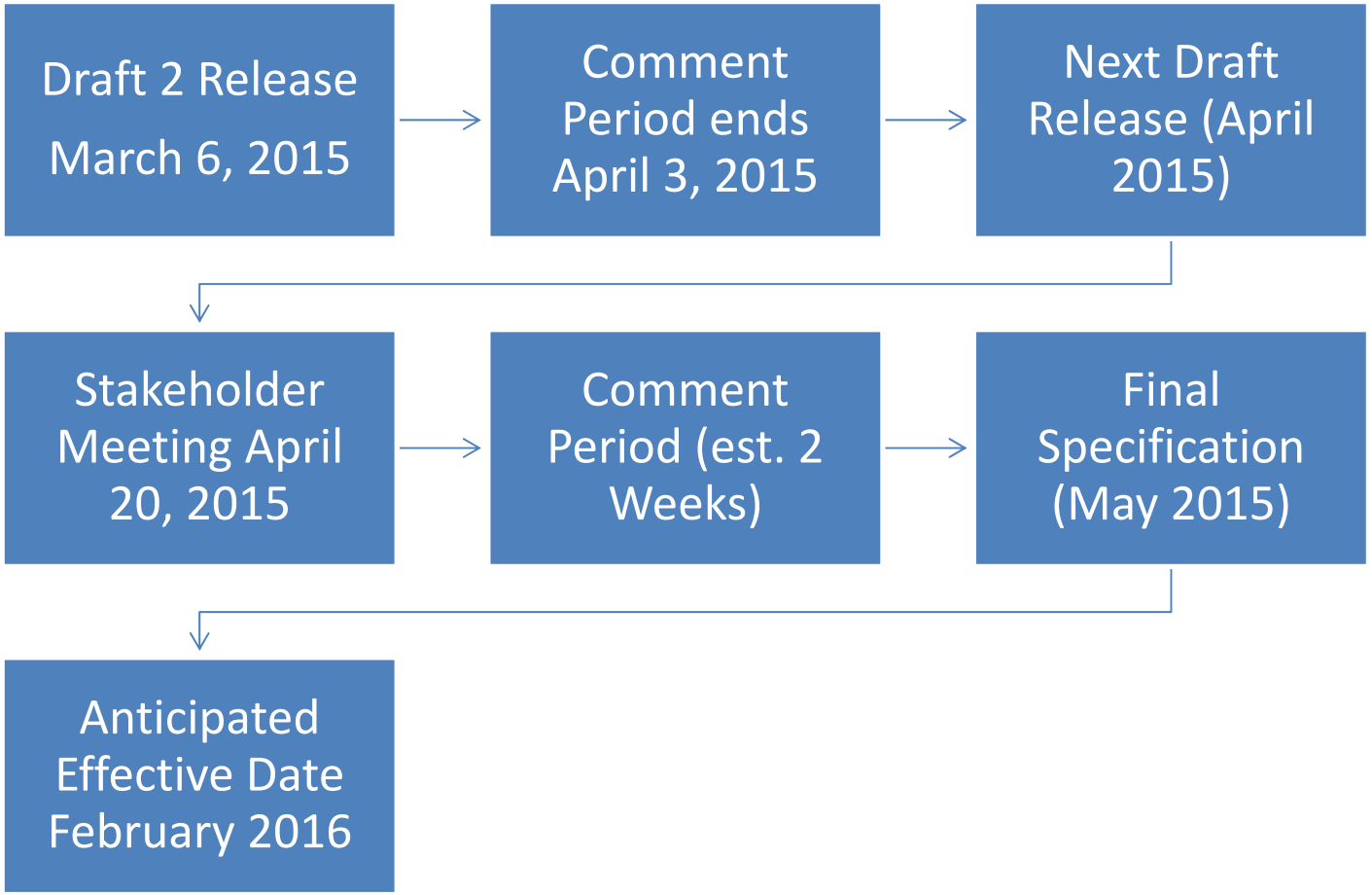
Section 15: Connected Luminaires

- Updates consistent with Lamps
- Removed references to grid standards, as lighting standards are still in development
  - Still in question:
    - Operational status reporting
    - Remote management
    - Energy consumption reporting

Section 16: Labeling and Packaging

- Clarification that the marketing and packaging of a product needs to be consistent with the certification.
- Proposed nomenclature for communicating color temperature

Planned Timeline



Discussion time

- Questions?
- Send comments and questions after the meeting to:
  lighting@energystar.gov

Section 9.2 Efficacy: Downlights

- Considerations of high CRI products:
- Downlights in Program: 3624
  - Downlights that meet efficacy: 50% (1820)
- Downlights In Program with 90+ CRI: 656
  - Downlights with 90+ CRI that meet efficacy: 52% (344)

Section 9.2 Efficacy: Accent Lights

- Considerations of high CRI products:
- Accent Lights in Program: 361
  - Accent Lights that meet efficacy: 39% (171)
- Accent Lights In Program with 90+ CRI: 64
  - Accent Lights with 90+ CRI that meet efficacy: 25% (16)