

ENERGY STAR. The simple choice for energy efficiency.



Lamps V2.0 Draft 1 Webinar

March 3, 2015

2-5 pm EST

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Today's Agenda

- Introduction
- Goals
- Specification Development Process
- Draft 1 Changes
 - Scope
 - Definitions
 - Photometric Performance
 - Lamp Packaging
 - Lumen Maintenance
 - Electrical Performance
 - Controls Requirements
 - Wrap-up and Timeline



Welcome

- Introductions
 - In-person
- Questions/comments welcome
 - For everyone's benefit, please state name before commenting
 - Can ask questions via the webinar at any time



Goals of the Specification Revision

- Provide for use of DOE's LED lamp test method
- Increase efficacy levels
- Broaden the scope and features
- Improve harmonization between ENERGY STAR lighting specifications

- *Not meant to be a major overhaul*
- *Capture improvement in LED lamps*



Specification Development Process Overview

- Timeline
 - Draft 1
 - Draft 1 released February 13, 2015
 - Webinar held March 3, 2015
 - Comment period closes March 13, 2015
 - Next Draft (subject to change)
 - Estimated release April 2015
 - In-person meeting and webinar April 20, 2015
 - 4-week comment period
 - Final Specification
 - Estimated release date Q2 2015
 - Effective date typically nine months later (Q1 2016)



Section 1: Scope and Section 4: Definitions

- Expanded to include:
 - Self-ballasted induction-driven electrodeless fluorescent lamps
 - Connected lamps
 - Color tunable lamps





Section 4: Definitions

- Definitions have been added for:
 - Induction-driven electrodeless fluorescent lamps:
 - A self-ballasted fluorescent lamp that uses electromagnetic induction to generate a discharge current, forming a closed loop inside the tube structure which excites internal gases and converts this into visible light through phosphor. For purposes of this specification, these lamps include integral electronic ballasts and are equipped with an ANSI standard base, and are also referred to as “induction lamps”.



Section 4: Definitions

- Definitions have been added for:
 - Connected lamps
 - An ENERGY STAR eligible connected lamp includes all elements *or instructions* (hardware, software) required to enable communication in response to consumer-authorized energy or performance related commands (not including third-party remote management which may be made available solely at the discretion of the manufacturer).





Section 4: Definitions

- Definitions have been added for:

- Color tunable lamps:



- For the purpose of this specification, a color tunable lamp has functionality that allows the end user to alter the color appearance of the light generated by the lamp. This tuning must include white light that is capable of meeting the specification's CCT requirements, and can alter the color appearance along the black body curve, or may also extend to colors beyond the ANSI defined correlated color temperature ranges.



Section 5.1 Testing Color Tunable Lamps

- Testing:
 - When testing a color tunable lamp, photometric performance testing (per section 9) shall be performed at:
 1. the default setting from the factory.
 2. the least efficient setting within ANSI white light CCT ranges (if different from the default and/or most consumptive) selected by the manufacturer.
 - The test settings described above shall meet all photometric performance requirements of the specification. All other testing, including lumen and color maintenance, shall be tested at the least efficient setting.
 - The power consumption of the setting with the maximum input power, regardless of chromaticity, shall be reported.
 - *Potential addition:* To ensure repeatability, the partner shall provide detailed instructions for reaching the least efficient and most consumptive modes.





Section 6: U.S. Federal Regulations

- DOE in process of rulemaking for test procedure for LED Lamps
- Once final, EPA will accept testing conducted to the DOE test procedure
 - Defines methods for measuring light output, CCT (relative spectral distribution), input power, efficacy, CRI, lifetime, and standby power
 - EPA seeks to align reporting for all lamps for consistency
 - EPA will assess next steps if the final version raises testing comparability issues



Section 7.1: Product Variations

- No changes proposed in Draft 1
- Stakeholders have requested to share lumen maintenance data among products with different CRI
- EPA needs data to support a technical rationale to consider including in the specification



Section 8: Methods of Measurement and Reference Documents

- Removed reference to outdated document:
 - ANSI/NEMA C82.2-2002
- Updated methods or added new methods:
 - DOE Energy Conservation Test Procedure for Light-Emitting Diode Lamp
 - ANSI C82.77-2014
 - IES LM-82-12
- Anticipated 2015 updates:
 - LM-65
 - LM-66
 - ANSI C78.377

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Photometric Performance Requirements



Section 9.1: Luminous Efficacy

ENERGY STAR CFL V4.3

Finalized: March 7, 2008

Effective: July 2009

ENERGY STAR Lamps V1.1

Finalized: August 28, 2013

Effective: September 30, 2014

Criteria Item	ENERGY STAR Requirements		
Lamp Power (Watts) & Configuration ¹	Minimum Efficacy Requirements: Lumens/watt (Based on initial lumen data ²)		
	Medium screw-base	Candelabra screw-base	GU24-base
Bare lamp (fixed light output)			
Lamp power < 10W	50	50	50
10W < Lamp power < 15W	55	55	50
15W ≤ Lamp power < 30W	65	N/A	50
Lamp power ≥ 30W	65	N/A	60
Bare lamp (Dimmable/2-way/3-way)			
Lamp power < 15W	50	50	40
Lamp power ≥ 15W	60	N/A	40
Covered lamp (no reflector)			
Lamp power ≤ 7W	40	35	40
7W < Lamp power < 15W	45	45	40
15W ≤ lamp power < 25W	50	N/A	40
Lamp power ≥ 25W	60	N/A	40
Outdoor reflectors			
Lamp power < 20	33	N/A	40
Lamp power ≥ 20	40	N/A	40

	Lamp Rated Wattage (watts)	Minimum Lamp Efficacy (initial lm/W)
Omnidirectional	<15	55
	≥15	65
Directional	<20	40
	≥20	50
Decorative	<15	45
	15 ≤ W < 25	50
	≥25	60

- Efficacy levels for the bulk of CFLs have remained largely unchanged since 2008
 - 10-15W bare spiral
 - 7-15W decorative



Section 9.1: Luminous Efficacy

ENERGY STAR Integral LED Lamps V1.0
 Finalized: December 3, 2009

Lamp Type		Efficacy Level
Omnidirectional	<10W	50
	≥10W	55
Directional	≤20/8 inch	40
	>20/8 inch	45
Decorative		40

ENERGY STAR Lamps V1.1
 Finalized: August 28, 2013
 Effective: September 30, 2014

	Lamp Rated Wattage (watts)	Minimum Lamp Efficacy (initial lm/W)
Omnidirectional	<15	55
	≥15	65
Directional	<20	40
	≥20	50
Decorative	<15	45
	15 ≤ W < 25	50
	≥25	60

- Minor increases across lamp types
- No changes for small diameter/low wattage directional lamps



Section 9.1: Luminous Efficacy

ENERGY STAR Lamps V1.1

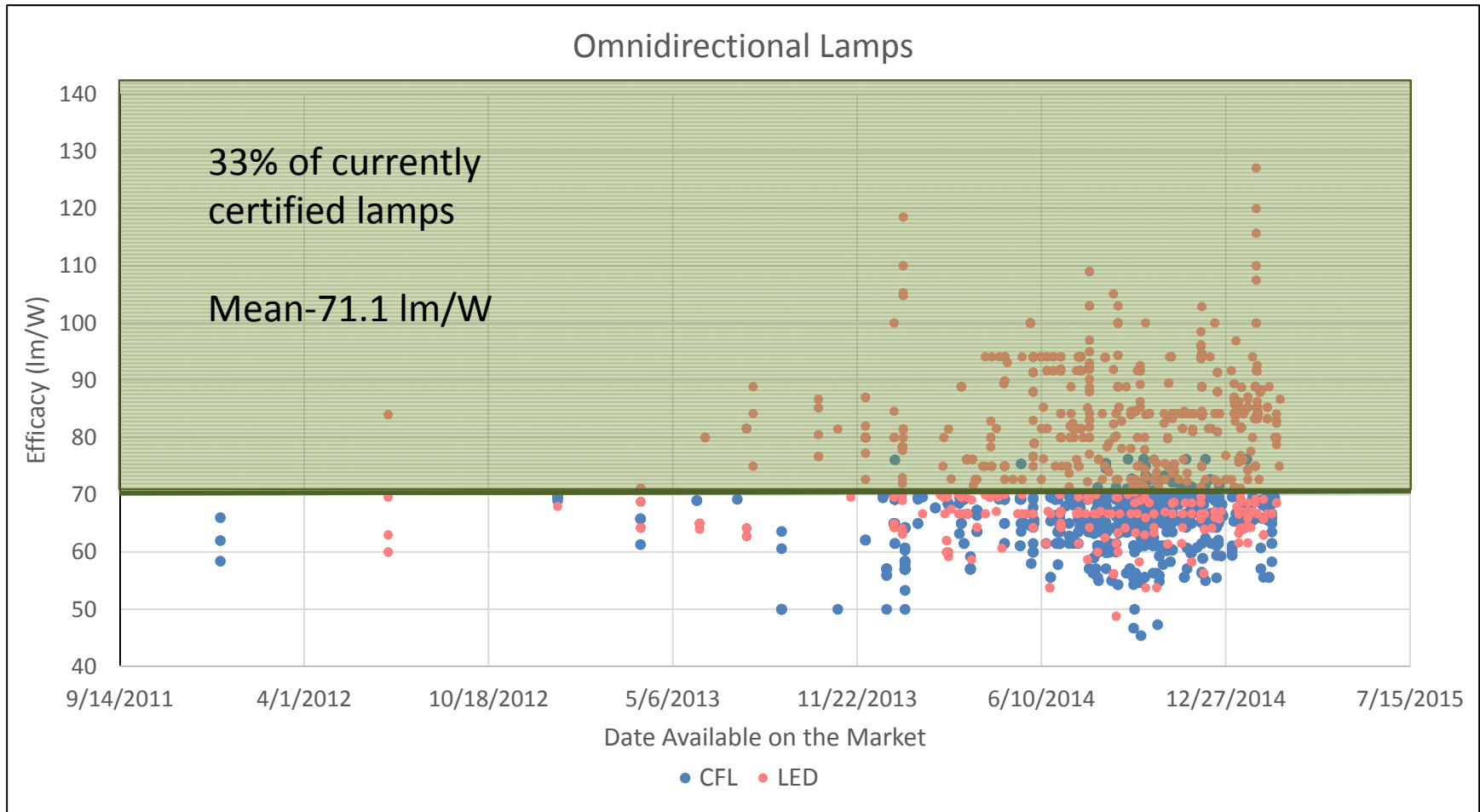
Lamp Type	ENERGY STAR Requirements	
	Reported values for each lamp model shall meet the applicable requirement in the table below. Additionally eight or more units individually shall meet the requirement.	
	Lamp Rated Wattage (watts)	Minimum Lamp Efficacy (initial lm/W)
Omnidirectional	<15	55
	≥15	65
Directional	<20	40
	≥20	50
Decorative	<15	45
	15 ≤ W < 25	50
	≥25	60

ENERGY STAR Lamps V2.0 Draft 1

Lamp Type	ENERGY STAR Requirements
	Reported values for each lamp model shall meet the applicable requirement in the table below. Additionally eight or more units individually shall meet the requirement.
	Minimum Lamp Efficacy (initial lm/W)
Omnidirectional	70
Directional	65
Decorative	65

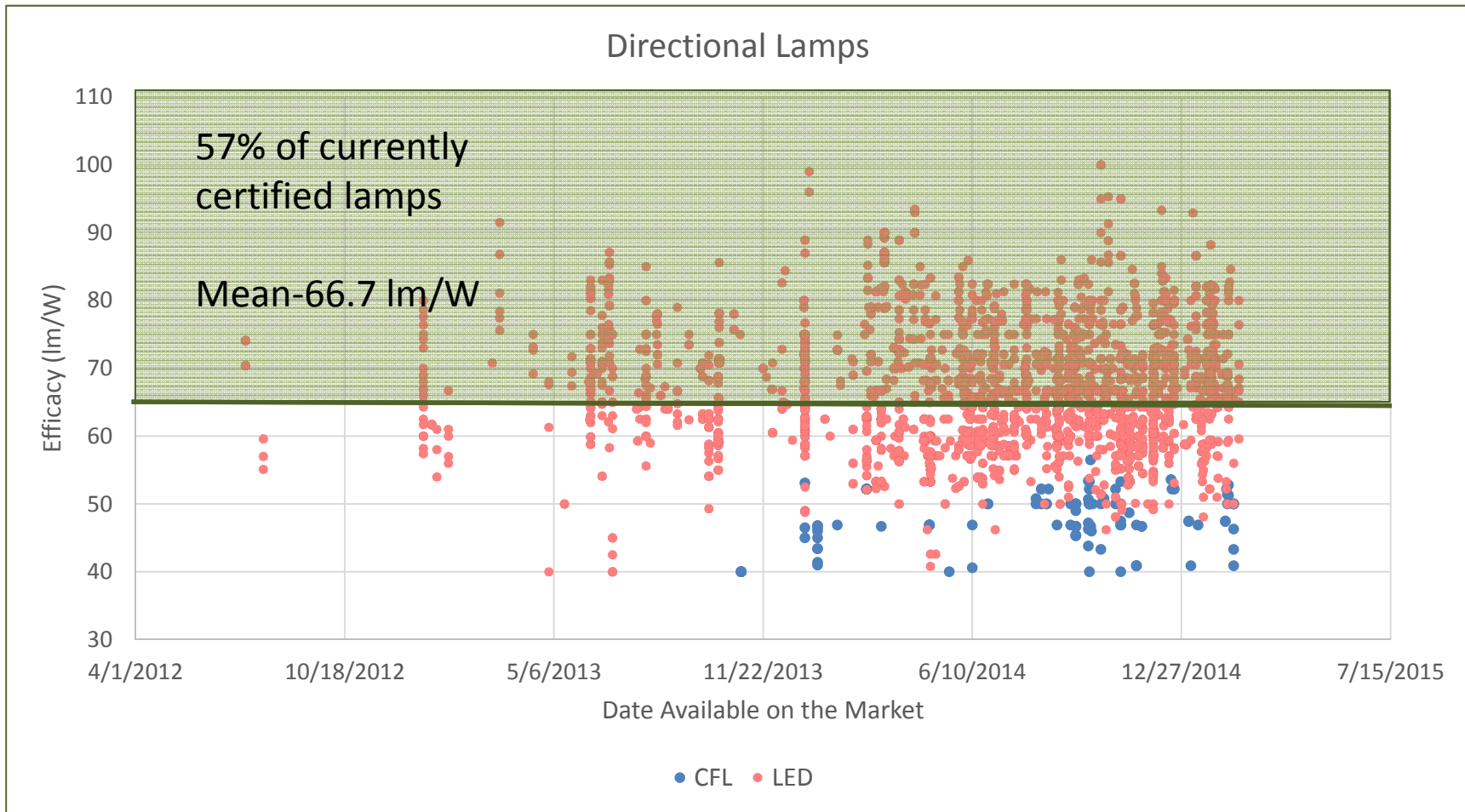


Section 9.1: Luminous Efficacy



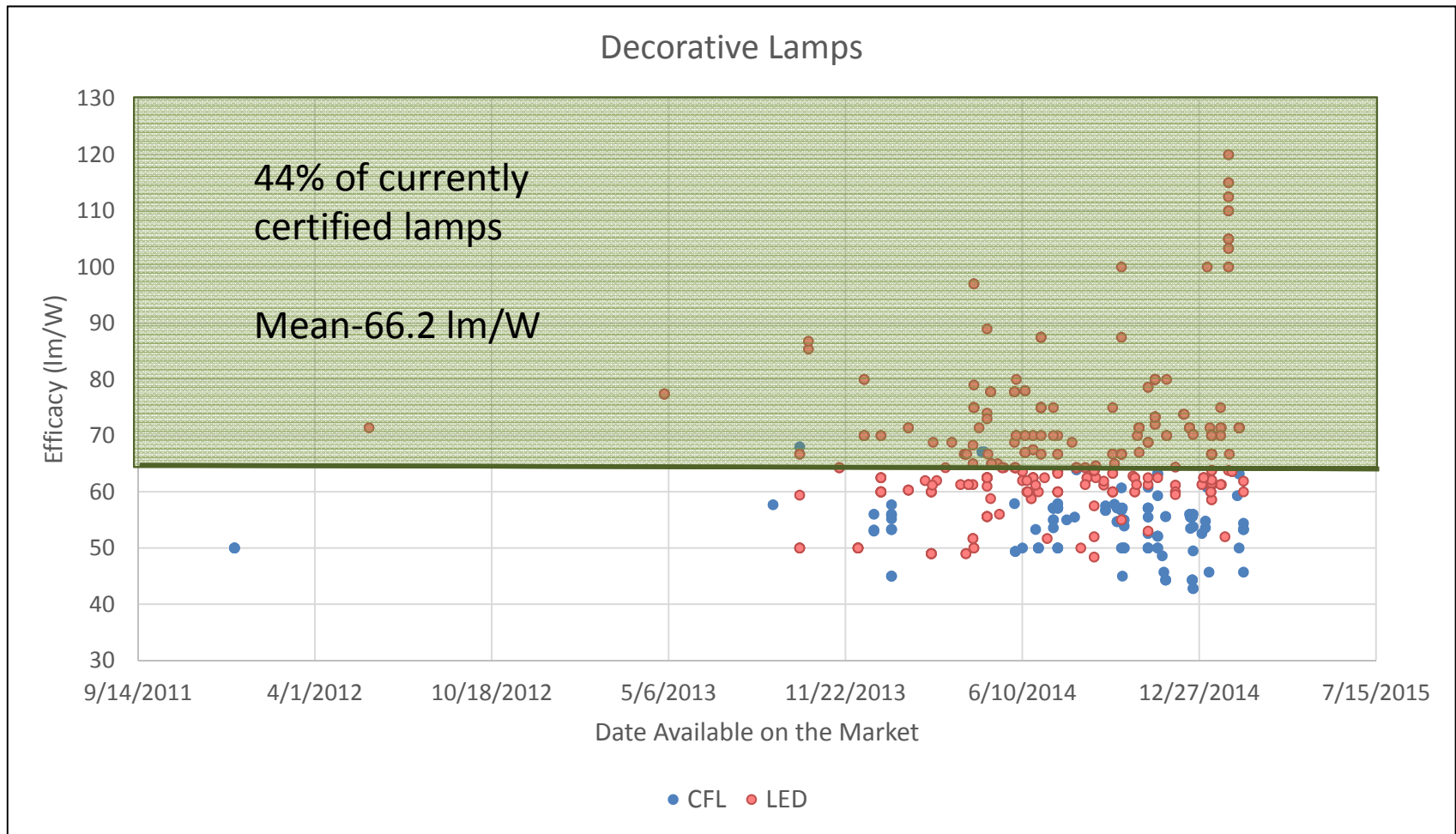


Section 9.1: Luminous Efficacy





Section 9.1: Luminous Efficacy





Section 9.2: Light Output

- EPA proposes to add a requirement that PAR and MR lamps report lumen output consistent with FTC labeling

Directional (PAR and MR)	Lamp initial light output (in lumens) shall be reported as the average of ten units.
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- EPA has added additional clarification regarding evaluating equivalency claims for 3-way lamps
 - 3-way lamps shall be evaluated for equivalency claims based on tested results at the highest input setting

Section 9.3: Elevated Temperature Light Output Ratio: All Directional Lamps

- IES LM-82-14 included as an alternate method of measurement for light output ratio testing of solid-state lamps
 - Method for the Characterization of LED Light Engines and Integrated Led Lamps for Electrical and Photometric Properties as a Function of Temperature





Section 9.4: Center Beam Intensity: PAR, MR and MRX Lamps

- Clarifications:
 - Measured center beam intensity value used to determine if the lamp can meet the performance of the target lamp
 - Any equivalency claims made must align with certified values

ENERGY STAR® Lamps V1.1 Center Beam Intensity Benchmark Tool		
Line Voltage PAR and MR Lamps		
Target Incandescent/Halogen Lamp Parameters		
Enter PAR/MR type/value:	<input type="text" value="16"/>	lamp diameter in 1/8 of in
Enter Nominal Lamp Wattage*:	<input type="text" value="20"/>	watts
Enter Nominal Beam Angle**:	<input type="text" value="60"/>	degrees
Minimum Center Beam Intensity:	<input type="text" value="149"/>	cd



Section 9.6: Correlated Color Temperature (CCT)

- Stakeholder interest in including 2200K and 2500K?
- EPA seeks data:
 - Demonstrating consumer demand
 - Quantifying energy savings opportunity
- Descriptor terms for colors would need to be developed for consistent consumer understanding



Section 15.2: Lamp Packaging

- Current color labeling is confusing consumers and hindering adoption
- Introduced specific color nomenclature to be used on product packaging:
 - 2700K – Warm White
 - 3000K – Soft White
 - 4000/4100K – Cool White
 - 5000K – Daylight
 - 6500K - ??





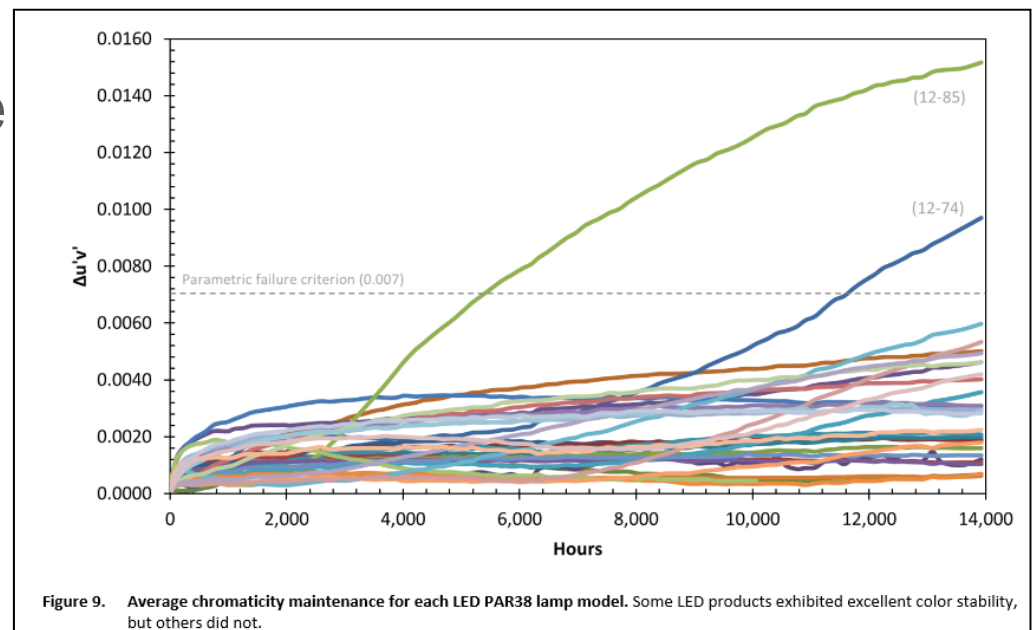
Section 9.7: Color Rendering: All Lamps

- Proposed requirement of $R_9 > 0$
- 82% of lamps on the ENERGY STAR Certified Lamps Product List have an $R_9 > 0$
 - 96% of lamps that meet the proposed efficacy requirements have $R_9 > 0$



Section 9.8: Color Maintenance

- Concern about color shift after 6,000 hours
- Proposing to extend the evaluation period to all testing points
- No additional testing required
 - Information captured when measuring for lumen maintenance



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Lumen Maintenance Requirements



Section 10.1: Lumen Maintenance

- Added references to DOE LED Test Procedure
 - Removed tolerances for lumen maintenance
 - All units must now be included in average calculations for lumen maintenance



Section 10.1: Lumen Maintenance

- Consistent with ENERGY STAR Luminaires:
 - Added reference to ENERGY STAR TM-21 Calculator
 - Added supplemental guidance for items to be included in TM-21 Report
 - Additional guidance for color tunable lamps
 - For color tunable lamps, the TM-21-11 projection for all LED colors used shall meet the requirement



Section 10.1: Lumen Maintenance

- Ambient testing proposed only for lamps labeled “not for use in totally enclosed or recessed fixtures” on the lamp and lamp packaging

The following shall be tested in accordance with the ENERGY STAR Ambient Temperature Life Test in an ambient temperature condition between 20°C and 35°C:

- Lamps labeled “not for use in totally enclosed or recessed fixtures” on the lamp and lamp packaging



Section 10.1: Lumen Maintenance

- Early certification instructions for CFLs moved from the Appendix to the Lumen Maintenance Section

Initial Certification:

A product may be certified based on partial life testing, and shall meet all other requirements of the specification as certified by an EPA-recognized Certification Body. Initial certification occurs at 40% of rated life for CFLs and 3,000 hours for LED lamps. A product photo is required to identify the current version of the certified product.

Packaging Review: Electronic or hard copy labeling and packaging samples are required for the specific model. Packaging must meet all of the requirements identified under the Lifetime and Packaging Requirements. The specific certified model must be distributed within this approved product packaging.

Due Date: A due date for the final average rated life time test report must be established based on the date the lifetime test began and the rated lifetime of the model. Products that meet the above requirements may be considered certified for ENERGY STAR and may be labeled.

Rated Lifetime (hours)	Early Interim (40% Rated Life) (hours)	Full Certification (hours)
10,000	4,000	10,000
12,000	4,800	12,000
15,000	6,000	15,000
20,000	8,000	20,000



Section 10.3: Rapid Cycle Stress Test

- Removed requirement for LED Products to undergo the rapid cycle stress test
 - Still required for CFLs
 - Test not found to appropriately stress LED driver electronics
 - EPA will consider including an appropriate test method for solid state once one is developed

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Electrical Requirements



Section 11.1: Electrical Safety

11.1. Electrical Safety: All Lamps

Lamp Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
All Lamps	Lamp shall comply with ANSI/UL 1993-2012, and ANSI/UL 8750-2009 as applicable.	Reference: ANSI/UL 1993-2012 ANSI/UL 8750-2009	Connected products must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions.



Section 11.2: Power Factor

- Updated to most recent test method for both solid state and CFL
 - ANSI C82.77-10-2014



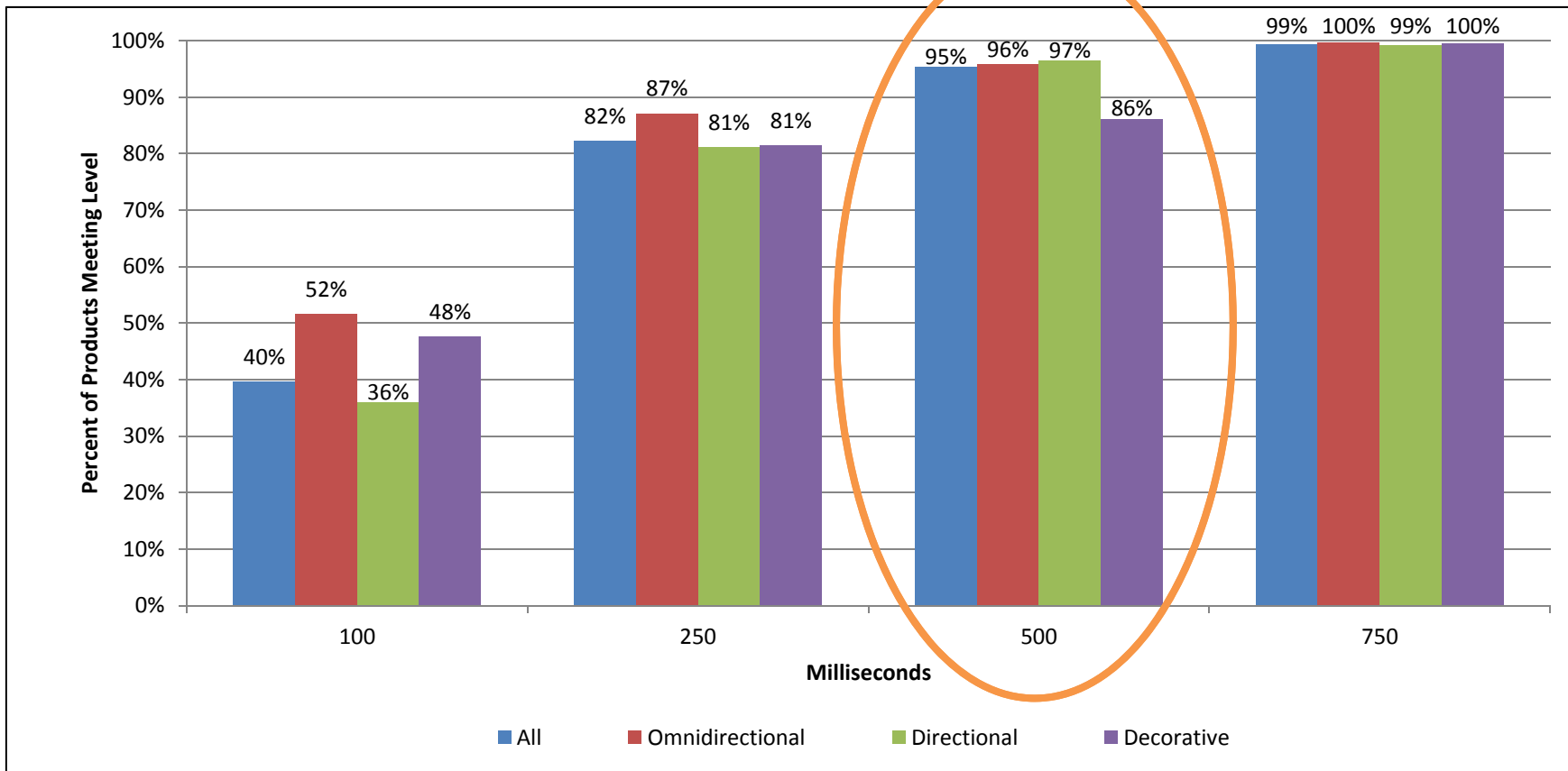
Section 11.3: Frequency

11.3. Frequency: All Lamps

Lamp Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
Compact Fluorescent	Lamp shall have a frequency within 20 to 33kHz, or ≥ 40 kHz.	None	<p>Sample Size: One unit per model.</p> <p>For purposes of third-party certification, documentation shall not be reviewed when products are certified or during verification testing.</p>
Solid-State	Lamp light output shall have a frequency ≥ 120 Hz.		<p>Sample Size: One unit per model.</p> <p>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.</p> <p>For purposes of third-party certification, documentation shall not be reviewed when products are certified or during verification testing.</p>



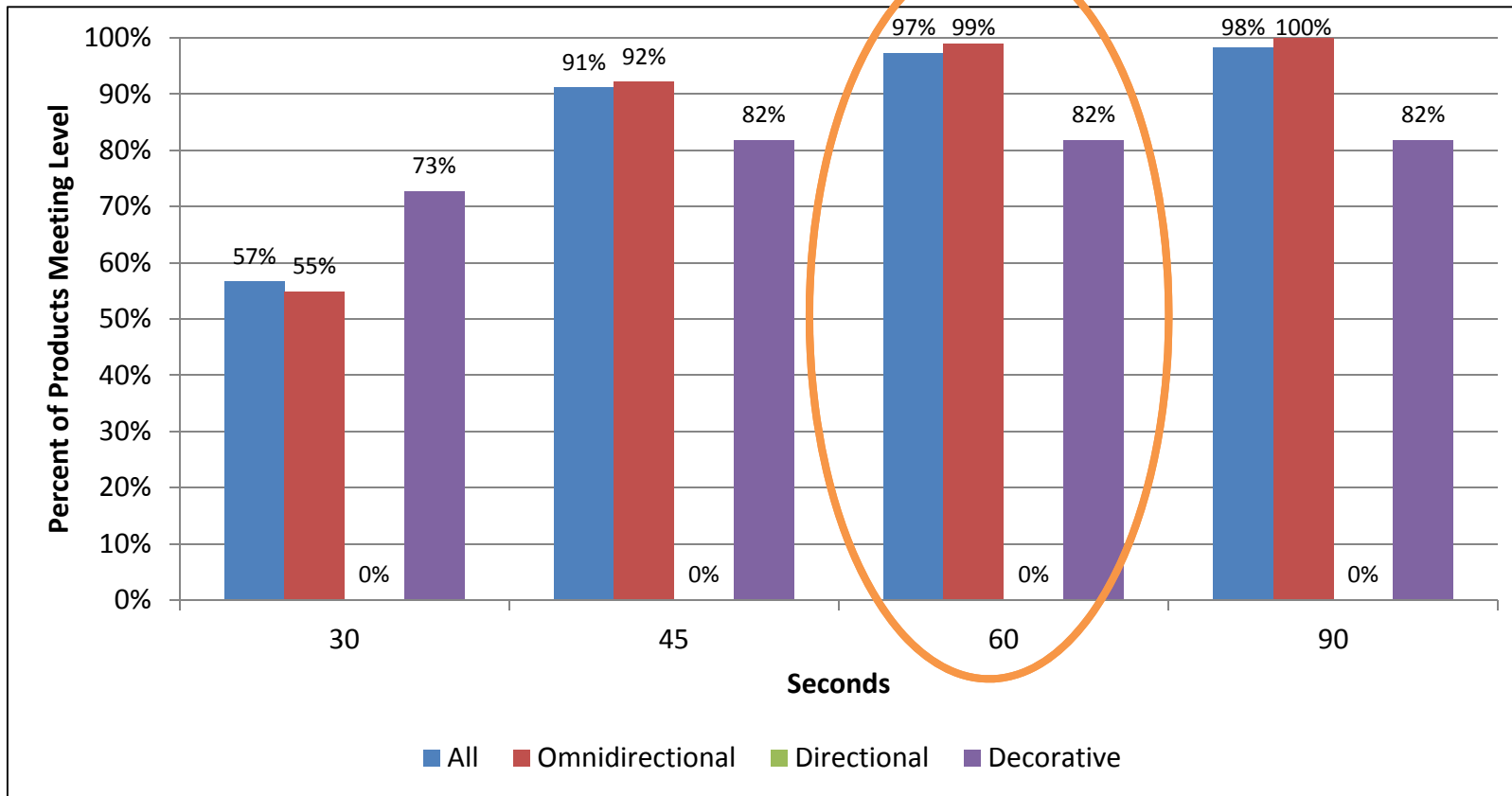
Section 11.4: Start Time



- Proposed: Start time must be ≥ 500 milliseconds of application of electrical power.
- 95% of lamps that meet the proposed efficacy levels have a start time of 500 milliseconds or less.



Section 11.5: CFL Run-Up Time



- Proposed: Lamp must achieve 80% stabilized light output in ≤ 60 seconds.
- 97% of lamps that meet the proposed efficacy levels have a run-up time of 60 seconds or less.



Section 11.7: Standby Power

- Reference to DOE LED Test Procedure

11.7. Standby Power Consumption: All Lamps

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
All Source Types	<p>Lamps incorporating an integral method of switching shall not draw power in the off state.</p> <p><u>Exception:</u> Lamps with integral motion sensors, photosensors, or connected functionality shall consume no more than 0.5 watt in the off state.</p>	<p>Method of Measurement: U.S. Department of Energy Test Procedure for Integrated Light-Emitting Diode Lamps</p>	<p>Laboratory test results shall detail off-state power consumption to the tenth of a watt.</p> <p>To be recognized as connected, a "connected lamp" shall include the base lamp plus all elements (hardware, software) required to enable communication in response to consumer-authorized energy related commands (not including third-party remote management which may be made available solely at the discretion of the manufacturer). These elements may be resident inside or outside of the base lamp. This capability shall be supported through one or more means, as identified in Section 12.7 Connected Product Criteria.</p>

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Controls Requirements



Section 12: Controls Requirements

- New section for lamps with connected functionality
 - Consistent with ENERGY STAR
Luminaires V2.0 Draft 1



12.6. Products with Connected Functionality – Optional

Source Type	ENERGY STAR Requirements	Methods of Measurement and/or Reference Documents	Supplemental Testing Guidance
All source types	<p>Product must continue to comply with the applicable product safety standards – the addition of the functionality shall not override existing safety protections and functions.</p> <p>May not consume more than 0.5 watts when in standby mode.</p>	Method of Measurement: None	<p>Test Requirements: Connected products without color tuning capabilities shall be tested at full power for all applicable requirements. Connected products with color tuning capabilities shall be tested under the conditions specified under Section 5.1.</p> <p>Compliance with connected functionality requirements shall be demonstrated through examination of product and/or product documentation.</p>



Section 12: Controls Requirements

12.7. Connected Product Criteria:

To be recognized as connected, a “connected lamp” shall include the base lamp plus elements or instructions required to enable communication in response to consumer-authorized energy related commands (e.g. connection hub, instructions for downloading a mobile application, Bluetooth syncing guidance). These elements may be resident inside or outside of the base lamp.

Connected lamps typically communicate with controls via a radio frequency system, although some versions utilize other methods (such as DMX or DALI). The specific design and implementation of the connected lamp is at the manufacturer’s discretion provided it is interoperable with other devices via open communications protocol and enables economical, consumer-authorized third party access to the functionalities provided for in sections 12.9, 12.10 and 12.11.

12.8. Open-standards & Open-access

1. Communication that enables connected functionality, (sections 12.9 – 12.12). must use, for all communication layers, protocols that are open and interoperable.
2. The product shall enable connectivity by one of following means:
 - a. open-standards communications from the lamp, or
 - b. open-standards communications from an external controller, included with the product or available separately.
3. To enable interconnection with the product; an interface specification, Application Programming Interface (API) or similar documentation shall be made available to interested parties that enables sections 12.9, 12.10 and 12.11 connected functionality, and includes accuracy, units and measurement interval for Energy Consumption Reporting



Section 12: Controls Requirements

12.9. Energy Consumption Reporting

The product shall be capable of interconnecting with consumer authorized entities to communicate data representative of its interval energy consumption. It is recommended that data be reported in watt-hours for intervals of 15 minutes, however, representative data may also be reported in alternate units and intervals as specified in the product manufacturer's interface specification or API.

12.10. Operational Status Reporting

At a minimum, the product shall be capable of providing the following information to energy management systems and other consumer authorized devices, services or applications via a communication link: operational status; e.g. on/off, color and luminous intensity.

12.11. Remote Management

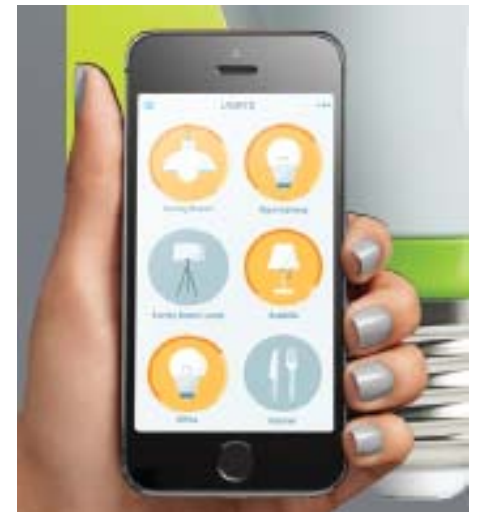
The product shall be capable of receiving and responding to energy management system or other consumer authorized remote requests, via devices, services or applications, similar to hard-wired consumer controllable functions.

12.12. Information to Consumers

If additional devices, services, and/or infrastructure are required to activate the product's connected capabilities, prominent labels, or other forms of consumer notifications shall be displayed at the point of purchase and in the product literature. (e.g. "This product has Z-wave control capability and requires interconnection with a Z-wave controller to enable local lighting control.")

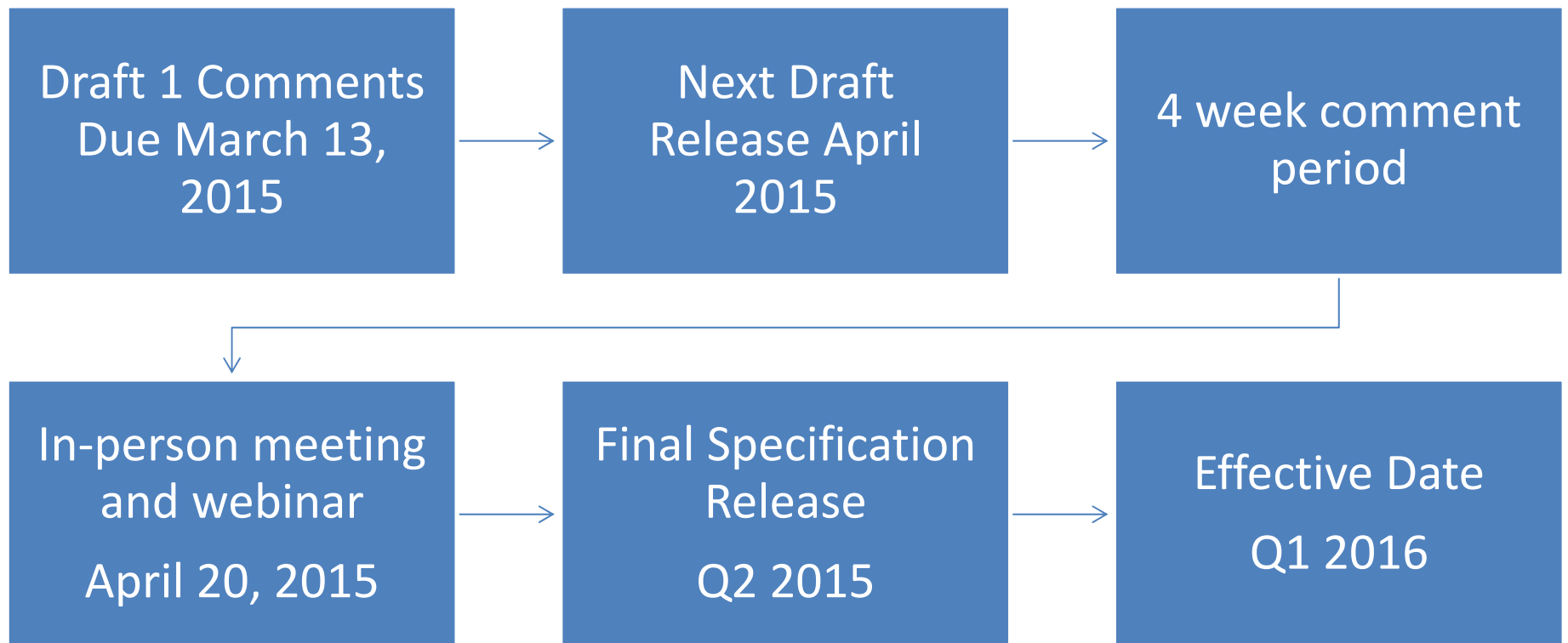
Section 12: Controls Requirements

- Questions for stakeholders:
 - What do stakeholders envision for operational status reporting to assist in enabling consumer desired features and how might the spec reflect this?
 - What are stakeholders' thoughts about third-party remote management as it relates to various aspects of the connected criteria?
 - Which if any current solutions are already enabling third party remote management related to energy consumption, and operation status?





Next Steps: Specification Development Process Overview





Discussion Time

- Questions?
- Send comments and questions after the meeting to:
lighting@energystar.gov by March 13, 2015

Please put “ENERGY STAR Lamps V2.0
Draft 1 Comments” in the subject line

