



ENERGY STAR® Luminaires V2.0 Specification Discussion Document October 2014

Please send comments to lighting@energystar.gov no later than
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Introduction

With this ENERGY STAR Discussion document, EPA is launching the specification revision process for Luminaires version 2.0 and seeking early stakeholder feedback on potential changes to the specification's approach and scope. Since the Luminaires V1.0 was released in 2011, the lighting industry has made significant advancements in the performance and efficiency of luminaires which have led to new opportunities to differentiate based on efficiency and innovation. In this document, EPA discusses the goals for this revision and notes a set of questions intended to facilitate discussion with interested stakeholders. EPA encourages stakeholders to review this document in conjunction with [ENERGY STAR Luminaires V1.2](#), as the current specification will serve as a good reference point.

Goals for Luminaires V2.0

With this revision, EPA aims to provide flexible yet robust pathways to recognize long lasting, high quality, energy efficient residential luminaires. EPA recognizes that rapidly evolving technology requires specification updates and consideration of new approaches.

The primary goals for Luminaires V2.0 fall into three key categories:

- A. Streamlining and simplifying the specification requirements, testing and the certification process
- B. Increasing efficacy levels to keep pace with the technology and capture greater energy savings
- C. Adjusting scope and increasing flexibility to broaden the selection, customization and availability of a wide variety of ENERGY STAR certified luminaires

Streamlining Requirements, Testing and Certification

EPA and the National Electrical Manufacturers Association (NEMA) co-hosted a series of collaborative road mapping sessions for lighting stakeholders. To support this effort and to examine program requirements with systematic input from stakeholders, NEMA conducted a survey of stakeholders to assess the importance of numerous performance criteria¹. The survey results did not show any majority opinion that any requirements were "not important". The two areas rated by the most participants (just over 30% of participants) as "not important" were requirements around toxics and lamp current crest factor.

¹ 26 stakeholders participated in the survey on Luminaires including manufacturing representatives, utilities, environmental advocates, and others. More information available at <http://www.energystar.gov/products/spec/lightingroadmapping>.

EPA has also examined the results of the verification testing which has been conducted on luminaires since 2012. Among the requirements demonstrating a low failure rate, start time stands out as a potential candidate for removal. In addition, review of other requirements with somewhat higher failure rates (i.e. color angular uniformity and zonal lumen density) indicate that adjustments to the requirements or test procedure may be warranted to avoid unnecessary failures.

Based on input and analysis to date, the following requirements are currently being considered for potential modification or elimination.

Color angular uniformity:

There is an ongoing debate about measurement sensitivity and the difficulty in obtaining repeatable results for color angular uniformity between accredited laboratories. As a result, EPA is considering revising the requirement that the variation of chromaticity be within 0.006 from the weighted average point on the CIE 1976 (u',v') diagram and only look at the area of interest, the beam. This would be consistent with the ENERGY STAR Lamps specification.

Start time:

74% of certified luminaires start in half a second or less, as do 97% of lamps certified to the new ENERGY STAR Lamps specification. In verification testing start time has one of the highest passing rates, and advances in ballast and driver performance suggest that the market has evolved to the point that ENERGY STAR may no longer need to include start time as a requirement.

Lamp current crest factor (CCF):

While limiting the CCF provided to a lamp from a ballast was intended to help ensure a long life for discharge lamps, electronic ballasts have evolved to where the market is composed primarily of ballasts that provide a low CCF. As a result it may no longer be necessary for CCF to be evaluated as a part of the ENERGY STAR program.

Zonal lumen density:

EPA has received input from some stakeholders that end-user needs are varied, and existing zonal lumen density requirements for some product types are not always appropriate. EPA seeks input from stakeholders on adjustments to the zonal lumen density requirements that might allow for alternative end-user needs for the following directional categories: under cabinet lights, cove lights, and non-symmetrical downlight or accent light options.

In an effort to reduce testing burden and improve product selection for consumers, EPA is looking to expand allowable light sources and expand allowable variations for sharing test data.

Stakeholders have expressed a desire for a mechanism to scale directional Solid-State Lighting (SSL) luminaires performance based on a worst case configuration for efficiency and lifetime/lumen maintenance (the highest wattage/lumen density) to reduce testing costs. EPA is considering simplifying program requirements by only requiring an integrating sphere test to support photometric performance for directional models that are of the same basic construction and function but vary in wattage and light output.

EPA is open to input on additional methods or practices that the program could adopt to simplify and/or streamline luminaire certification further with technical justification. Maintaining high levels of reliability and customer satisfaction are top priorities for the program.

Discussion questions:

1. What, if any, other adjustments should be considered for the color angular uniformity requirement for directional luminaires?
2. Which additional zonal lumen density requirements, if any are necessary for cove lighting, under cabinet lighting, downlighting or accent lighting?
3. In order to allow for scaling based on worst-case, the primary consideration would be power density of the fixture and the light source. Are there other considerations that need to be evaluated?
4. Are there additional testing considerations for scaling directional luminaires outside of a simple integrating sphere test?
5. What additional or alternate approaches that work with EPA's third party certification scheme for allowable variations should be considered to help reduce testing costs?
6. Do stakeholders have any additional suggestions for simplifying or reformatting the specification to improve the clarity and ease of use?

Changes to Efficacy Levels

Since Luminaires V1.0 went into effect in April 2012, the lighting industry has made significant improvements to the performance and efficiency of luminaires. What once were challenging performance and efficiency levels are more easily achievable and available on the market for some categories. Some product categories are already exceeding the DOE R&D targets for efficiency and continue to advance at a rapid pace. Raising efficacy to levels that are already being achieved and signaling future levels based on the rapid progression will allow the program, stakeholders and end users to plan ahead and capture greater savings.

Luminaire categories that have made large gains in efficiency and may warrant re-evaluation are below.

- Recessed Downlights: more than half of certified recessed down lights and 94% of certified solid-state down light retrofit kits are performing at least 20% higher than the minimum efficacy requirement.
- Accent Lights: 83% of certified products are performing above 50 lm/W, compared to a current efficacy requirement of 35 lm/W.
- Cove Lighting: 97% of cove lights are ≥ 55 lm/w compared to the current requirement of 45 lm/W.
- Under cabinets: 88% of products are performing ≥ 45 lm/w compared to the current requirement of 29 lm/W, and 52% of products are performing at 65 lm/W or higher.
- Outdoor Porch Wall Mounts: 90% of products are performing 15 lumens per watt above the minimum requirement.

Given the tremendous opportunity to capture savings, EPA is considering setting efficacy targets that are achievable for the anticipated effective date of the specification and future targets based on the expected progression of efficient lighting technology to capture the greatest amount of savings while maintaining cost effective solutions.

Discussion questions:

1. Why are SSL downlight retrofit products performing at much higher efficacies than recessed downlight luminaires? Given the existing 700+ million installed base of recessed cans and the overall higher efficacy of retrofits currently certified is having a different efficacy level for downlight retrofits compared to complete luminaires appropriate?
2. What cost considerations, if any are associated with higher efficacy levels?

Changes to Product Category Scope:

EPA will continue to focus on residential luminaires, including products commonly sold into both residential and commercial markets. In examining the scope of the program, EPA has identified promising new product categories where ENERGY STAR can add value as well as categories where the program no longer adds additional savings.

New and Expanded Product Types:

New opportunities for savings with efficient lighting have emerged due to technological advances and industry innovations. As such EPA is looking at possible scope expansions, namely:

- Additional retrofit products both for directional and non-directional luminaires.
- Downlight and accent light variations that target non-circular beam patterns.
- Luminaires with controllable and communicating functionality: e.g. color tunable and/or connected luminaires.

The ENERGY STAR program has taken a systematic approach to addressing intelligent “connected” products in several product categories. Given the industry growth in controllable lights and the potential for energy savings and consumer benefits, this revision provides the opportunity to address intelligent luminaires consistent with other ENERGY STAR products with connected functionality.

Fixtures that Ship without Light Sources:

EPA has evaluated the category and practice of allowing products that ship without light sources to qualify for the program and intends to remove this category from the scope of the specification for the following reasons: Fixtures that use linear fluorescent lamps make up the majority of certified products that do not ship with lamps. These products are highly efficient and EPA expects them to remain so due to a backstop created by a U.S. Department of Energy (DOE) standard that requires accredited testing of these lamps. As such, EPA sees diminished value in certifying fixtures that ship without light sources.

- a) Outdoor motion sensor based lights are now available with efficient hardwired LED light sources, so luminaires that ship with screw based halogen lamps are no longer the more efficient solution.
- b) The vast majority of the specification requirements are photometric and without an included light source the actual performance of these fixtures is unknown.

Light Source Flexibility: The Evolution of the LED System

As LEDs become a more mainstream approach to lighting, their incorporation into luminaires has taken varied approaches, some of which were not considerations when Luminaires V1.0 was developed. The inseparable SSL category has become the default category for luminaires that have source solutions that do not fit the definition of an LED light engine. EPA continues to place high value on replaceable parts for serviceability and conservation of materials. Some of the existing module type approaches are replaceable but are lacking one or more aspects of the current definition of an LED light engine, so must be categorized as inseparable. This revision process now provides an opportunity to look at the usefulness of the current definition of LED light engines as it applies to the ENERGY STAR luminaires program, and modify definitions to keep pace with industry trends and new technologies.

Light Source Flexibility: Dedicated Sockets

ENERGY STAR has had separate lighting specifications for replacement lamps and luminaires. Part of this distinction was based on the historic lack of choice in the bulb category for efficient lamps that would perform well inside luminaires and the concern of end users swapping out efficient light sources with

incandescent bulbs negating energy savings. EPA continues to encourage efficient design solutions for luminaires that take full advantage of the technology and create efficient, long-lasting, lighting solutions.

During the past 5 years there have been dramatic improvements in the available shapes, efficacy, performance and cost of ENERGY STAR certified bulbs. The current consumer need is pairing the appropriate high quality efficient light source with the fixture. As a result, EPA is examining a certification path that would allow luminaires to ship with ENERGY STAR certified screw based lamps. Allowing this pathway could significantly streamline product certification. This change could also improve the availability of high quality, efficient decorative luminaires for consumers, and ease replacement with an efficient bulb, as needed.

The restricted base approach presents challenges which include:

- Pin based bulbs are a barrier to consumer adoption, and are not as readily available as replacements.
- Pin based bulbs limit the minimum size of the light source, as the fluorescent pin based and GU24 bases are relatively large bases.
- LED light engines, as defined in the Luminaires specification, may not be aesthetically appropriate for all luminaires and have not been widely accepted and available.
- Not all luminaire manufacturers have the resources to develop integrated LED systems for use in their luminaires.

Consistent with the current luminaires light source approach, EPA anticipates continuing to include an in-situ test (not to exceed the lumen maintenance test temperature), and an LM-82 test to support certified lamps for use in certified luminaires to ensure that the lamp would perform at the required level when operated in the luminaire and continue to perform over time.

Discussion Questions:

1. As the end user experience is unknown without a light source shipped with the fixture, and the DOE has recently increased the regulation of linear fluorescent lamps, what benefits, if any, still exist for ENERGY STAR labeling of luminaires that do not ship with a light source?
2. In revisiting the definition of an LED light engine to improve flexibility and reflect market directions, what definitions or details in addition to the Zhaga definition of LED light engine should EPA be considering? Zhaga defines an "LED light engine" or LLE as *the combination of one or more LED modules, together with an LED driver (also known as electronic control gear, or ECG)*.
3. If the definition of an LED light engine were to be expanded to include replaceable modules that rely on the luminaire for heat dissipation and optical control, would the inseparable SSL category still be necessary, if so, why?
4. For luminaires shipped with ENERGY STAR certified LED lamps, would LM-82 testing be necessary if a light output ratio test were performed during lamp certification?
5. EPA has identified a few ENERGY STAR luminaire categories that may also benefit from an ENERGY STAR retrofit option, such as wall sconces and ceiling mounts. This would reduce material costs and luminaire light losses, and potentially allow for better optimization of light. Are there additional retrofit or new residential directional categories that EPA should be considering?
6. Are there additional areas of residential lighting with significant energy saving potential that EPA should be considering for inclusion in the specification? New product suggestion proposals should include energy savings potential, market information and technical performance considerations.

Conclusion

All stakeholders are encouraged to provide feedback on the concepts presented in this document. Communication between EPA and industry stakeholders is critical to the success of the ENERGY STAR program, especially in this early stage of the specification development process. We encourage our stakeholders to gather feedback from all areas of their companies; from engineering to QA/QC to marketing, anyone whose work is impacted by changes to the ENERGY STAR specification. Program representatives are available for additional technical discussions with interested parties at any time during the specification development process. Please send a message to lighting@energystar.gov or to Taylor Jantz-Sell at Jantz-Sell.Taylor@epa.gov to arrange a discussion.