

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460



OFFICE OF  
AIR AND RADIATION

July 8, 2008

Marc Hoffman  
Executive Director  
Consortium for Energy Efficiency  
98 North Washington, Suite 101  
Boston, MA 02114-1918

Dear Mr. Hoffman

The U.S. Environmental Protection Agency (EPA) wishes to thank CEE and its member organizations for the thoughtful comments submitted in its letter of July 2, 2008. CEE members have raised a variety of important issues which EPA wants to fully address. We would like to address some of them in this letter, particularly those that can be addressed through better clarification of (1) the process EPA used to recognize light emitting diode (LED) technologies in its ENERGY STAR residential lighting specification and (2) how important quality issues are being handled. We hope to address additional issues in the near future as we have more opportunity to coordinate with the Department of Energy and others.

As we believe the technical amendment to the Residential Light Fixture (RLF) Program specification, version 4.2, does address many of the issues you have raised as we will outline below, we do not intend to suspend the technical amendment. However, we do understand that a variety of stakeholders are interested in providing comment on this technical amendment. To this end, EPA will shortly be announcing that we are accepting written comment on Residential Light Fixture Program specification, Version 4.2 until August 25, 2008 and that after this period, EPA will compile the comments received and consider the appropriateness and timing of any suggested changes.

General Comments:

First, I would like to clarify why EPA used a technical amendment to allow LED technologies to qualify for the ENERGY STAR. The recently announced amendment added new test procedures designed to allow a subcategory of fixtures employing LEDs to compete on a level playing field to meet pre-existing, unchanged performance requirements. This amendment was provided to remove a competitive disadvantage for this subcategory of fixtures that was particularly apparent upon the availability of the new testing procedure referenced in the amended specification. The amendment allows LED-based residential fixtures to qualify only if they can meet existing performance thresholds, the most important of which provides for 75% energy savings over incandescent fixtures. With this extension of a technology-neutral approach, in keeping with ENERGY STAR Guiding Principles, subjective evaluations have been removed: product performance testing will determine if and when this technology is mature enough for qualification under the longstanding performance requirements.

EPA took this step due to several compelling factors, including:

- These types of light fixtures would not be eligible for the ENERGY STAR Program based on the specification that is effective in September, 2008
- Fixture manufacturers and others want to qualify their LED-based fixtures - not covered elsewhere in the ENERGY STAR Program - under the Residential Light Fixture Program, given that their products can be shown to perform similarly to the products that can already qualify based on other technologies; a number of Partners have requested this opportunity.
- A new testing procedure for LED lighting products became available that allowed LED-based fixtures to be tested and shown to meet the requirements of the ENERGY STAR Residential Light Fixture specification
- This new testing procedure for LED lighting products was developed through a representative group of LED industry stakeholders reflecting a broad constituency. While it is not the product of a standards setting body, this ASSIST Recommends procedure was developed in a manner consistent with the approach taken for other test procedures both within the context of the ENERGY STAR Residential Fixture Program and a range of other ENERGY STAR product categories.

Further, a technical amendment is an appropriate step for this change as the scope of the Residential Light Fixture Program remains unchanged and the required performance levels remain unchanged. The scope includes fixtures that are used in “single and multi-family dwellings, dormitories, public or military housing, assisted-living facilities, motels and hotels, and some light commercial applications” (as outlined in the RLF specification). Qualified products include pendants, wall sconces, chandeliers, ceiling mounts, bath bars and others, all sharing one common characteristic: their design is not driven by performance goals as found in commercial and industrial fixtures, but by aesthetic value. These fixtures are also generally non-directional in nature. In this way the scope of the RLF Program is complementary to the ENERGY STAR SSL V1.0 specification, which as of July 2008 primarily includes directional applications.

### Technical Comments:

#### Scope

EPA agrees with CEE on the importance of developing a clear and precise definition that outlines which fixture applications meet the “directionality” criteria. Furthermore, EPA supports logical program segmentation within ENERGY STAR using established lines within the lighting industry. Residential light fixture manufacturers represent a small subset of a much larger industry, and face consumer pricing pressures beyond those seen in the commercial and industrial segments. It is important to remember that ENERGY STAR is only successful if consumers purchase qualified products. Source-based performance evaluation of fixtures has made ENERGY STAR qualification of nearly 12,000 residential light fixture models economically viable for RLF Partners. Adoption of more burdensome whole-fixture performance testing, as commonly performed with commercial lighting, will potentially upset this dynamic, reduce Partners’ abilities to offer a broad range of decorative energy efficient fixtures to today’s consumers, and provide performance data of dubious value. Segmentation of ENERGY STAR lighting efforts by industry segment would help to address the comments and concerns of the residential light fixture manufacturing community, as represented by the American Lighting Association, whose members have worked with the RLF Program for more than eleven years.

## Technology Differences

EPA agrees that LEDs are a very different technology from any other, but the same statement holds true for each lighting technology commonly in residential use. Each energy efficient lighting technology employed within the ENERGY STAR Program has unique operating characteristics and design requirements different from the others. What is common among all of them is the need to manage thermal performance; unlike incandescent and halogen lighting, they do not thrive on heat. As is the case indeed with all electrical goods, LEDs require thoughtful thermal management, with conduction and subsequent convection as the dominant mechanisms, rather than convection and radiation as with other light sources.

And while LEDs do not provide the omnidirectional ‘blob of light’ delivered by many lamps, the most common high powered LED packages do provide multidirectional output. The high powered LED packages most commonly deployed in general illumination radiate in a hemisphere, from one side of a flat plane; in fact luminaire manufacturers commonly employ secondary optics to create directionality when little exists from the LEDs themselves. Residential fixture manufacturers partnered with the RLF Program have already made great strides in their understanding of optical design for LEDs. Following new developments from the lamp industry to create novel, aesthetically pleasing fixture designs is what drives RLF manufacturing Partners – without this ability, these companies would not survive.

## Efficacy

EPA agrees that establishing a level playing field for multiple technologies is critical to the success of the RLF product category, as well as the larger ENERGY STAR Program. For this reason EPA is referencing a source-based testing procedure for these general illumination or decorative residential fixtures. Luminaire efficacy data (i.e. delivered lumens per watt) is not available for residential light fixture products, because this type of testing is not practiced by this segment of the lighting industry. Further, luminaire efficacy data is not directly comparable to source-based efficacy data, and is inappropriate for evaluation of aesthetically motivated designs. The addition to the RLF Program of LED testing procedures for general illumination or decorative fixtures based on source efficacy allows meaningful comparisons of fixtures employing different technologies, while providing at least a 75% energy savings over incandescent lighting. This percentage represents the greatest savings of any ENERGY STAR labeled product category. Further, EPA’s observations of the residential lighting market over the past decade have produced two consistent truths: consumers make purchasing decisions in this product category based on aesthetics and cost, and consumers will not compromise on either for the sake of increased luminaire efficacy.

EPA believes there are important questions to answer with regard to the value of a separate, different approach to the evaluation of fixture performance, especially given the results do not allow consumers to make a meaningful comparison between similar qualifying products employing different technologies. For example, at many retail outlets consumers compare ENERGY STAR qualified outdoor light fixtures employing fluorescent, high pressure sodium and time-limited incandescent technologies. Each of these products has received the ENERGY STAR label because they exceed predetermined thresholds for energy savings and other performance criteria versus inefficient alternatives which dominate the market. Likewise, an outdoor fixture employing LEDs should be evaluated in largely the same way, held against the same performance thresholds, to enable consumers and utilities to trust that fixtures using the newest technology will deliver the 75% energy savings they have come to expect of ENERGY STAR qualified outdoor residential light fixtures.

We agree with your statement that consistency across products is critical, and for this reason encourage the evolution to a single set of performance thresholds - for a given product category rather than a specific technology – which offers consumers and utilities a clear understanding of products’ performance, regardless of the technology employed.

## Specification Revisions

The Residential Light Fixture Program last year accounted for 15 million units shipped, representing 5% of market share. One of the successes of the RLF Program has been the ongoing refinement of the specification and the enhanced quality in lighting products that has yielded. Specification revisions – the strengthening of requirements – have historically been undertaken only when fixtures qualified under a given version have led to meaningful market penetration. Waiting for significant market uptake of products meeting a given set of requirements has allowed Partners time to learn from these advances and develop a greater understanding of the market for energy efficient lighting. A review of RLF specifications V1.1 (1997) through V4.2 (2008) demonstrates how the specification has evolved, with each revision reflecting new lessons learned about consumer preferences and the market for residential energy efficient lighting.

## Color and Light Output

EPA agrees that color and light output are important quality issues, and that we do not want to see the mistakes of the early CFL designs repeated. EPA also believes that the recent technical amendment addresses these issues in a reasonable manner. The ENERGY STAR Residential Light Fixture Program requires the reporting of light output and color temperature. The manufacturers will need to support any claims made. Further, an examination of ENERGY STAR qualified indoor fixtures shipping with a lamp shows that 89% were qualified under RLF V4.x with a 2700K or 3000K lamp; only 0.21% of indoor fixtures were qualified with a 5000K or 6500K lamp. It is apparent from this that over the past eleven years, RLF Partners have developed an understanding of consumer color preference. RLF Partners have worked closely with EPA on the nine year old Change a Light, Change the World campaign, and have had their products subjected to the same level of retail scrutiny as retrofit CFLs. EPA will collect the information it needs to vigorously guard the ENERGY STAR brand and the RLF Program: if RLF Partners are found to be straying from their evident understanding of consumer color preference to attempt qualification of high CCT, low light output products, EPA will intervene.

## Test Procedures

The ASSIST Recommends test procedure for LED light engine performance evaluation was developed in a manner consistent with the approach taken for other test procedures both within the context of the ENERGY STAR Residential Light Fixture Program and a range of other ENERGY STAR product categories. It was developed by the Alliance for Solid-State Illumination Systems and Technologies (ASSIST), a stakeholder group including the largest LED package manufacturers such as CREE, GE Lumination, OSRAM Sylvania, Philips, Seoul Semiconductor, as well as NYSERDA and others. The ASSIST group is responsible for many important advances with LEDs, including the industry-adopted definition for the useful life of LEDs, known as  $L_{70}$ . The newest testing procedure published by ASSIST provides for elevated temperature testing of LED light engines to evaluate photometric, electrical and thermal performance at several elevated ambient temperatures, the highest of which approaches the known failure point for the LED packages. It is noteworthy that this level of testing sophistication is not included in the IESNA LM-79 testing standard; EPA is working with the LM-79 committee to incorporate this type of testing in a future revision of the document.

## Lumen Depreciation

EPA appreciates CEE members' recognition of LED lumen depreciation as an important performance criterion, the evaluation of which remains largely unresolved by the lighting industry. Although public drafts are not available for review, it is our understanding that the as-yet unfinished IESNA LM-80 testing standard does not provide for extrapolation of lumen depreciation to  $L_{70}$ , an important gap. Consistent with the lessons learned from CFLs regarding the need for new lighting technologies to meet consumer

expectations, EPA believes that this gap needs to be addressed in an open and transparent manner before LM-80 is ready to be widely useful as a performance screening tool within the ENERGY STAR Program.

In the interim, the RLF V4.2 specification references ASSIST recommendations for lumen maintenance / life. This fully documented, publicly available test procedure accounts for heat and allows for an L<sub>70</sub> life projection using a 6,000 hour test. This is currently the most comprehensive test available, as we wait for developments with LM-80.

### Conclusion

Again, I thank you for your comments and hope that I have addressed many of the issues you have raised. I am happy to continue to answer questions and work to resolve remaining issues; please feel free to contact me at any time: [baker.alex@epa.gov](mailto:baker.alex@epa.gov), or (202) 343-9272.

Sincerely,

A handwritten signature in black ink, appearing to read 'Alex Baker', with a long horizontal flourish extending to the right.

Alex Baker  
ENERGY STAR Lighting Program Manager  
U.S. Environmental Protection Agency