

May 15, 2007

To: Richard Karney, Energy Star Program Manager

From: NEMA Solid State Lighting and Luminaire Sections

Re: Comments on Second Draft of Energy Star Criteria
for Solid State Lighting Luminaires

Thank you for the opportunity to provide comments on the second draft of Energy Star Program Requirements for Solid State Lighting Luminaires, issued on April 9. We look forward to continuing to work with you to improve the program criteria. Accordingly, we convey the following series of suggestions, discussions and questions for your consideration. The order of our comments follows the course of the draft criteria.

Comment on All Criteria

The rationale for the Category A requirements is that the LED systems perform at least as well as fluorescent (CFL) systems. This makes sense for applications for which fluorescent lighting is well suited. For applications where incandescent lighting is best suited (for example, reflector lamps in recessed cans), the "fluorescent" rationale is unduly restrictive, since there is a lot of energy savings associated with substituting LED systems for incandescent or halogen systems.

Scope

Since they seem to meet the definition of a luminaire given on page 20, we assume that existing luminaires equipped with a retrofit LED lamp (replacing an existing incandescent or halogen reflector lamp) will be part of the overall Energy Star Program. In fact, this type of retrofit may become the fastest way to achieve tangible energy savings in the short term. If nothing else, clarification is needed on this matter.

Luminaire Requirements

Color Spatial Uniformity (Page 4)

The color uniformity requirement may be too restrictive as defined in Draft 2. The original suggestion was for a du'v' displacement at any point not exceeding 0.004 from the weighted average color point. We recommend adding this phrase back into the language of the definition.

Off-state Power (Page 5)

We recommend that a maximum off-state power draw be specified as part of exception criteria.

Device Array Requirements (Page 5)

We suggest reconsideration and better explanation of the 35,000 hours threshold for lumen maintenance for residential systems. On what data is Energy Star relying in order to propose setting the 35,000 benchmark? Are 35,000 hours really required for residential products? At 3 hours per day, 35,000 hours is about 30+ years. Would more energy be saved by shortening the life (L70) of residential products and driving them harder (higher efficiency)? Reducing the lifetime requirements for residential applications could potentially help introduce more energy efficient, cost reduced lighting into the residential marketplace. Based on the estimated hours of daily use, systems intended for commercial applications would have a longer threshold.

The lumen maintenance criterion should specify that the threshold is determined “at a specified maximum temperature measured at a specified location on the device.”

There is some confusion in the overall document about whether the “lumen depreciation” [lifetime] requirement applies to the device or to the entire luminaire. On page 5, it is clear that the requirement applies to the device or array, and this section of the document applies to “all luminaires.” On pages 17-18 an option #2 is given (for Category B luminaires) where the criterion applies to the entire luminaire. The document could be clarified on this point by noting on page 5 that lumen depreciation documentation on the entire luminaire can be substituted for the “device/array” requirement.

Outdoor Luminaires (Page 5)

The requirement for an automatic daylight control for residences at first seems to make good sense, but on more reflection may be energy wasteful. There may be many outdoor luminaires that are not intended to be used every day (patio light, porch light), or certainly not all the dark hours every day, and for these applications a simple switch could be more energy saving than an automatic daylight control. In the porch light example, there could even be good reason for (rarely) having it on before dark, and this would be precluded by the requirement as written. What is the intended goal of the proposed control requirement? Please provide a rationale for the proposal.

Maximum Measured Driver/Driver Case Temperature (Page 6)

This requirement assumes that luminaire manufacturer and driver manufacturer are not one-in-the-same. In the case where the luminaire manufacturer or systems integrator is designing their own integrated supply, in-situ (stand-alone) recommendations may not exist. How should this be addressed?

Category A: Near-Term Applications

Luminaire Efficacy

1. The Luminaire Efficacy equation (page 7) uses luminaire light output within the calculation, however, it does not mention critical variables such as:
 - a. Output tested at start-up, or at thermal equilibrium? We have noticed SSL luminaires can suffer approximately 15% light output loss after they heat-up.
 - b. Output tested in open air, or in application? A recessed fixture, for example, will run hotter and therefore less efficiently in application than in open air.
 - c. We believe that 25°C ambient is implied, however, we do not see where it is stated.

We feel that each of these parameters should be considered within the requirements.

Under-Cabinet Lighting (Pages 9-10)

There are separate application requirements for “Under-cabinet kitchen lighting” and “Under-cabinet shelf mounted task lighting” (pages 9-10). There may be application overlap for any single light fixture, so it may become difficult to categorize the fixtures in this manner. We see no need to differentiate between these applications and think that combining them into a more general category such as “Linear Lighting” may be more appropriate.

The minimum light output requirements specify “150 lumens per linear foot,” where “linear foot” refers to the fixture length; this may not be appropriate for SSL luminaires. SSL does not need to be in a “rectangular” configuration. The paradigm that under cabinet lighting must be shaped like a TL lamp/fixture may not be valid for SSL. For example, one can envision several separate round SSL devices (wired together) to provide excellent under cabinet lighting. As another example, one can imagine a single circular luminaire, say 4” in diameter, that would provide excellent lighting; in this case, what is important is the spacing of such luminaires under the cabinet (i.e., how many of the luminaires per linear foot of the cabinet), and you can’t tell that from testing a single luminaire. Therefore, the “linear foot” may not be the best requirement. Would a “lumens per cabinet area (bottom surface area)” be better, or “lumens per counter top area?” What about a “zonal flux density (from a fixed distance)” requirement?

Within the “Under-cabinet kitchen lighting” application requirement (page 9), the allowable CCTs are limited to 2700K, 3000K, and 3500K. The comments on allowable CCTs at the top of page 9 have been noted, however, we still feel the customer should be allowed to choose whatever CCT they wish. We believe, for example, some customers may request 4000K. In addition, what is the rationale for listing specific CCTs; why not have an acceptable range consistent with the quadrangles specified in

ANSI C78.377A (chromaticity standard)? Energy Star should supply a better rationale for the separation of the “kitchen” and “shelf-mounted “ applications.

Within the “Recessed downlights” application requirement (page 10), the apertures listed each use the term “nominal”. Instead, it may be clearer to state a range (example: Aperture 4”+/- ½”). This would provide a much clearer requirement and prevent anyone from classifying a 4-7/8” aperture as 4” nominal and attaining the Energy STAR rating with only 300 lumens.

Within the “Minimum Light Output” and “Zonal Lumen Density Requirement” for several application requirements (pages 9-11), the phrase “lumens (initial)” is used. It should be stated that the luminaire should be at thermal equilibrium, in application, with a 25°C ambient when measuring initial lumens. However, has Energy Star considered how installation of an IC rated recessed downlight fixture will change the efficacy rating that can be achieved, where 25C does not replicate the IC environment?

The final requirements should include an explanation of the rationale underlying the differences in luminaire efficacies specified among the different applications (pages 9-11). In addition, to avoid confusion, the zonal density requirement should be clarified and explained since the intent may not be clear and the requirement can be misinterpreted (Is the “0-60° zone” a 60° cone of light, or a 120° cone of light?).

Category B: Future Performance Targets (Page 12)

We support the 70 lm/w threshold performance standard for those applications intended to replace fluorescent systems, however we strongly object to the proposed three year waiting period to begin qualifying products in Category B. We are confident that the current technology is capable of meeting the performance standards for some of the major markets and commercial availability of these products is very near. We feel the Energy Star program will have an important impact on customer acceptance of SSL, however if the Category B SSL Energy Star program is shelved for three years the program will likely miss the market launch. This is a critical time as the market will be developing its perception of the technology and ultimately determining the level of acceptance. The market would clearly benefit from Energy Star labeling at this critical period and frankly missing this period due to an arbitrary three-year waiting period will jeopardize the technology and make the SSL Energy Star program irrelevant. If a company can qualify sooner, why should they be penalized by having to wait?

We recommend opening Category B as soon as the standards are complete and begin qualifying products as soon as possible, allowing technology to set the pace.

The draft 2 text says “All other requirements will be the same as those in effect for Category A at the time Category B becomes effective, except for” But different applications in Category A have different CRI requirements (or none at all), different allowed CCTs, etc. How do these carry over to Category B, which makes no distinction among different applications?

What is the reasoning behind eliminating the zonal lumen density requirement in Category B? Is it that at > 70 lm/W the light output is of sufficient brightness to parity incumbent technologies used in these applications and therefore do not require additional light distribution constraints? Further clarification on this point would be welcome.

NVLAP Accreditation (Page 13)

It is not clear whether after the one-year suspension of the NVLAP requirement, products approved during the first year will have to be re-tested and re-qualified. Manufacturers certainly do not want to bear the burden of re-testing, especially if their procedures have not changed appreciably during the one-year period. On the other hand, the quality of the measurements during first year could be very uneven. We do not believe it is at all plausible that an aggressive quality assurance (QA) testing program can compensate for this. While we do not have a solution to offer at this time, we do have a couple of ideas to put forth for your consideration:

- Rather than suspending NVLAP accreditation for a year, Energy Star could require that all measurements during the first year be made in a laboratory that has NVLAP accreditation for making measurements on some other non-LED lamp type; or
- Require that all products qualified in the first year be re-qualified within 2 years of the date when the NVLAP accreditation process is finalized. These are not polished ideas, but are suggested here to highlight the need, and to initiate some thinking about a solution.

Alternative Testing Procedures (Page 16)

We look forward to working with Energy Star on clarifying alternative testing procedures.

Product Variations: Variations within Product Groupings (Page 17)

We recommend adding a category “Mounting” to the variations table with an “Allowed” marking. Many products have alternate mechanical mountings that have no affect on the thermal performance of the product.

We believe the classifications presented could be too stringent. As an example, modifying a heat sink configuration in a simple way on an existing product, according to these requirements, would necessitate qualification testing (and the associated expense). However, we would argue that if a company could fundamentally show justification (e.g. performance improvement) of the thermal management design, they should not be required to re-qualify from scratch.

Product Variations: Qualification Process (Page 17)

The text describes a process for qualifying a family of products, but says nothing about adding members to that family after the initial qualification is made. We can visualize manufacturers modifying existing designs on a routine basis to meet customer needs. Many of the changes could be considered minor, and manufacturers will need a method to append or modify the Energy Star listings to include such new “minor” variations. A method could be as follows: Once an Energy Star file is set-up with an identified base model and acceptable variations, manufacturers could append the file by providing evidence that a new variation is essentially the same as the listed model. The Energy Star file will be appended with the addition, and the new variation would be Energy Star qualified.

A similar “adding members to a qualified family” process is needed even when the changes are not minor, but when the changes are clear improvements (due to the substitution of a more efficient driver with the same allowed driver case temperature, for example, or of more efficient LEDs of the same spectral output and flux but with lower input power and the same permitted junction/case temperature). Will increased luminous flux, better lumen maintenance, and/or better thermal management be required to be recertified? If a manufacturer can show that a change materially does not detrimentally affect performance, can a change simply be a file update? (Similar to UL’s process).

Product Variations: LED Allowed Conditions (Page 17)

The proposed allowed variation conditions for LED devices restrict changes in total flux. We object to this restriction as LED suppliers are continually improving the Lm/W performance and therefore the flux per package is increasing. As proposed, each transition to a higher flux bin would require retesting, despite the fact that the increased flux makes the product even more efficient.

We recommend allowing LED Flux bin increases without requiring retesting.

Lumen Depreciation Qualification (Pages 17-18)

At the top of page 18, the section noting PASS Requirements refers to temperature measurements relative to a corresponding drive current or higher. LEDs have a specified range of acceptable drive currents. One should not run an LED beyond its specified current range even if the temperature measurement can be kept within the limits. Instead the specification may read “... corresponding drive current or higher, within the manufacturer’s specified operating current range”.

Quality Assurance Testing

Multiple references are made within the second draft regarding a Quality Assurance (QA) Program. We understand the front-end process utilizing NVLAP accredited

laboratories for design qualification of product. However, less obvious is how the "policing" of production qualification and "product grouping" would be processed.

What are the triggers for qualification evaluation (random, periodic surveillance, customer complaint, competitive complaint)?

Will the same NVLAP accredited labs be responsible for surveillance testing? If so, who will pay for it, DOE?

We applaud Energy Star in its aspirations (i.e. "DOE will conduct an aggressive Quality Assurance (QA) program to insure the highest levels of conformance to the new standards and test procedures"). However, it would be helpful to understand the logistics behind the claim.

With regard to product failing a DOE QA test, there is no proposed process for appeal to address a variation due to a manufacturing/component defect. No manufacturing process is perfect, and at some time, a temporary manufacturing or component hiccup will occur. Then product or groups of products would potentially be de-listed and the manufacturer would suffer significantly. There needs to be a process where the manufacturer can respond and correct (recall if necessary) an unforeseen and unintentional manufacturing/component hiccup without the penalties of delisting, the expense of retesting products, and/or being barred from the Energy Star program for some time. Perhaps the Energy Star CFL appeal process can be used as a model.

Definitions

It is important that the program requirements differentiate between LED drivers and LED power supplies. Often LED power supplies are termed drivers when in fact this is misleading. A driver can be located inside the power supply or it can be located on the LED module. We recommend DOE change the term "driver" to "power supply" in all occurrences in this draft – assuming "power supply" is what is really meant in those occurrences; we think so.

Related to the driver/power supply definition, do the "driver" power factor requirements included in the second draft actually apply to the driver or were they meant to apply to the power supply?

We provide the definitions from the ANSI/NEMA standards work and commend them to Energy Star's attention:

- **LED lamp, integrated**
An LED device with an integrated LED driver and a standardized base that is designed to connect to the branch circuit via a standardized lampholder/socket.

- **LED lamp, non-integrated**
An LED device with no integral power source and with a standardized base designed for connection to a LED luminaire.
- **LED package**
An assembly of one or more LED die that contains wire bond connections, possibly with an optical element and thermal, mechanical, and electrical interfaces. The device does not include a power source and is not connected directly to the branch circuit.
- **LED array**
An assembly of LED packages on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical interfaces. The device does not contain a power source and is not connected directly to the branch circuit.
- **LED module**
A component part of an LED light source that includes one or more LEDs that are connected to the load side of LED power source or LED driver. Electrical, electronic, optical, and mechanical components may also be part of an LED module. The LED module does not contain a power source.
- **LED luminaire**
A complete LED lighting unit consisting of a light source and driver together with parts to distribute light, to position and protect the light source, and to connect the light source to a branch circuit. The light source itself may be an LED array, an LED module, or an LED lamp. The LED luminaire is intended to connect directly to a branch circuit.
- **Power source**
A transformer, power supply, battery, or other device capable of providing current, voltage or power within its design limits.
- **Power supply**
An electronic device capable of controlling current, voltage, or power within design limits.
- **LED control circuitry**
Electronic circuitry to limit voltage and current, to dim, to switch or otherwise control the electrical energy to the LED array. It does not contain a power source.
- **LED driver**
A power source with integral LED control circuitry designed to meet the specific requirements of a LED lamp or a LED array.

Reference Standards and Test Procedures

Regarding the FCC requirement for consumer vs. non-consumer use, the FCC CFR part 15 requirements no longer reference consumer vs. non-consumer. It is now "computing" vs. "non-computing". Only a "digital device" can be eligible to be tested for Class A compliance. All other Part 15 devices are limited to Class B compliance.

END COMMENTS