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via e-mail: lighting@energystar.gov

September 4, 2015

Mr. Peter Banwell
ENERGY STAR Program
US Environmental Protection Agency
1200 Pennsylvania Avenue NW
Washington, DC 20460

ENERGY STAR Lamps 2.0 Draft 3 Comments

Dear Mr. Banwell:

Philips Lighting appreciates the opportunity to provide the attached comments on the third draft of the Lamps v2.0 Specification.

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Philips is a diversified technology company, focused on improving people's lives through meaningful innovation in the areas of Healthcare, Consumer Lifestyle and Lighting. Innovation has been a cornerstone of the company's strategy for over 120 years, creating a strong and trusted Philips brand with market access all over the world. Philips is a leader in cardiac care, acute care and home healthcare, energy efficient lighting solutions and new lighting applications, as well as male shaving/grooming and oral healthcare.

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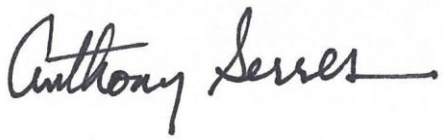
Please find our detailed comments below. We look forward to working with you further on this effort. If you have any questions on these comments, please contact me.

Sincerely,



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Comments on ENERGY STAR Lamps v2.0 Draft 3

September 4, 2015

General

We appreciate that Energy Star has added definitions for flicker, stroboscopic effect, and TLA. We also appreciate the wording changes in Section 12.8 and 12.9 for connected lamps and the change in test conditions for connected lamps which move the test condition from the lowest efficacy point to the highest consumption white point.

Furthermore, Philips echoes the comments submitted by NEMA and would like to emphasize the following points:

Section 1.1

We support the NEMA request to add the ANSI G53 base to the list of allowable bases.

Section 9.1 – Luminous Efficacy

Decorative

We note that the efficacy break for decorative product, which appeared in draft 2, has been removed. As written, at 65 LPW, the current efficacy requirement will all but eliminate the CFL decorative category, as well as some low wattage decorative LEDs. We note that comments submitted in response to Draft 1 ask Energy Star not to set the levels so high that CFLs can't meet them.

The break in Draft 2 was at 7W and applied to all lamp types. We suggest two different levels based on technology as shown below:

Compact Fluorescent	
Decorative < 10	50
Decorative ≥ 10	55
Solid-State	
Decorative ≤ 3	55
Decorative > 3	65 (Same as Draft 3)

There are few, if any CFL decorative products below 7W, thus a practical value to divide them is at 10W. From our perspective, the break for SSL product could go as low as 3W, although we support the NEMA proposal which is 7W.

Decorative SSL product exist below 7W, and some of them have efficacies exceeding 100 LPW. These lamps, however, have very specific design differences from standard product that need to be considered when setting efficacy limits. The issue with these lower wattage lamps is that typical driver efficiency for a dimmable topology is about 65-70%. Non-dimmable designs,

though, can reach 90% efficiency. Please refer to Appendix A of our comments for detail on a low wattage lamp design which shows a required efficiency of 75% which is not achievable in a dimmable design.

There are products on the Energy Star Qualified Products List with a low rated wattage (4W) and efficacies exceeding 100 lm/W, which may make the request for a low wattage efficacy break seem unreasonable. These are decorative 'filament' lamps, however, that are non-dimmable. As stated above, by being non-dimmable, higher driver efficiency can be reached. In addition, filament lamps contain many more LEDs than non-filament lamps (2-3 times more), and the LEDs are driven at substantially lower current and lower junction temperature, which yields higher efficacy.

Directional

As mentioned above, the proposed efficacy requirement for decorative lamps would eliminate those CFLs from the Energy Star program. The same is true for the 65LPW requirement for directional lamps. CFL reflector lamps are still much more efficacious than the incandescent lamps they replace and should be allowed to continue in the program. We propose the following limits for directional CFL lamps to maintain them as a viable and affordable Energy Star option for consumers:

Compact Fluorescent	
Directional < 20	45
Directional ≥ 20	55

Color Tunable

On the subject of color tunable SSL products, these lamps should be subject to the same final efficacy limits as standard, non-tunable product.

<u>Section 11.5 – Run-up Time CFL</u>

Another proposed requirement that eliminates all directional and decorative CFLs from the Energy Star program is run-up time. The 45 second requirement cannot be met by covered CFLs. As you know, covered CFLs require an amalgam to maintain the proper mercury pressure inside the discharge tube and thus, increase the efficacy of the lamps.

An inherent side effect of the amalgam is that it slows down the run-up of the lamp.

There are a number of options presented for run-up time in the NEMA comments. All are valid; we would like to reemphasize the first option here:

≤ 120 seconds for decorative (covered) and reflector CFLs,
≤ 60 seconds for other CFLs

Appendix A

Dimmable Lamp Design Example

The target is to design a dimmable decorative SSL lamp to replace a 25W incandescent lamp. Such lamp must emit at least 150 lumens per the equivalency table in Section 9.2.

At 65 LPW, without any design margin, the lamp must consume no more than 2.31W (150/65). Allowing for design margin, this becomes a 165 lumen, 2.2W product, which requires an efficacy of 75 LPW (165/2.2).

The available LED package has an efficacy of 130 LPW. Reduce that by the following:

- 15% for optical efficiency of decorative lamp optics
- 10% for thermal efficiency

This yields an efficacy of 99.45 LPW to begin the lamp design (130*0.85*0.9).

Divide 165 lumens by 99.45 LPW means 1.66W of input power would be required if the driver was 100% efficient. But we know it isn't.

Thus to achieve a final input power of 2.2W, the dimmable driver would need to be 75.4% efficient (1.66/2.2), which is slightly greater than existing dimmable technology provides (65-70%).

The table below summarizes the above analysis:

B1	150	Minimum lumens
B2	165	Design Lumens
B3	65	Required efficacy (lm/W)
B4 =B1/B3	2.308	Power to meet min light output with min efficacy (W)
B5	2.2	Power with margin (W)
B6=B2/B5	75	Design efficacy (lm/W)
B8	130	LED efficacy (lm/W)
B9	0.15	Optics losses
B10	0.1	Thermal losses
B11=B8*(1-B9)*(1-B10)	99.45	System efficacy without driver (lm/W)
B13=B2/B11/B5	75.4%	Required driver efficiency

END COMMENTS