

CALIFORNIA ENERGY COMMISSION

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November 23, 2015

Ms. Taylor Jantz-Sell
ENERGY STAR Program
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, MC 6202J
Washington, DC 20460
Via e-mail: Lighting@energystar.gov

RE: CALIFORNIA ENERGY COMMISSION'S COMMENTS ON ENERGY STAR
LAMPS SPECIFICATION 2.0, INTERIM PROPOSAL

Dear Ms. Jantz-Sell:

Thank you for the opportunity to comment on the U.S. Environmental Protection Agency's (U.S. EPA) ENERGY STAR Program Lamps Specification 2.0, Interim Proposal. The California Energy Commission (Energy Commission) has taken an active interest in the U.S. EPA's efforts to improve the ENERGY STAR Lamps Specification 2.0, particularly as the Energy Commission has adopted new high efficacy lighting specifications for its 2016 Building Energy Efficiency Standards that will include lamps in addition to luminaires, and is in the middle of a rulemaking to establish minimum efficiency standards for general service LEDs that are sold or offered for sale in California.

Overall, we are pleased to see the careful thought and effort that the U.S. EPA is devoting to the development of Lamps Specification 2.0, and are supportive in particular of the improvements in efficacy under consideration in the Interim Proposal. The proposed levels are cost-effective, technologically feasible, and representative of high-performing lamps currently available in the market. The Energy Commission is also supportive of the U.S. EPA's proposal for separate efficacy limits based on color rendering index (CRI). This will mitigate unintended pressure to lower color quality to meet the specification and help ensure that consumers have access to ENERGY STAR efficient products at various CRI levels.

The U.S. EPA's decision to propose higher efficacy levels comes at a time of unprecedented importance for the program and lighting energy consumption in the nation. Consumers are faced with a growing number of options for filling their

screw-base sockets and are increasingly choosing between one LED versus another and whether to buy an LED or a CFL. Under the Draft 3 proposal, the ENERGY STAR label would have been found on some of the least efficient bulbs on the market in California, where only CFLs and LEDs will be available when a 45 lumen-per-watt standard for general service lighting goes into effect in 2018.¹ The proposed revision properly reverses that outcome.

We offer the following comments to provide additional information for the U.S. EPA's consideration and to encourage the U.S. EPA to retain the strong levels for power factor and omnidirectionality that it presented in earlier drafts, as changes to these factors will not dramatically decrease lamp cost but will negatively impact lamp performance.

I. The Energy Commission supports the efficacy levels in the Interim Proposal.

The Energy Commission strongly supports the proposed efficacy levels in the Interim Proposal. The U.S. EPA proposal encourages improvements to efficiency and avoids potential unintended pressure toward lower color quality. While the classic definition of efficiency is described in terms of work output per work input, the work output of general service lighting is more complex due to the characteristics of the human eye and color vision. This fact is embodied in the term commonly used as efficacy, where the unit of measure, the lumen, incorporates the eye's sensitivity to different wavelengths of light. While lumen is a good measurement of perceived brightness, it does not measure the other key feature of general purpose lighting—the ability to differentiate between colors. The U.S. EPA already clearly acknowledges the importance of this aspect of general purpose lighting through its minimum CRI and R9 requirements. Removing red color content from LED lamps is a pathway to improving lumens per watt, but the resulting lamps do not achieve their core purpose as well. By allowing for tradeoffs between CRI and efficacy, the Interim Proposal incentivizes highly efficient general purpose lamps while recognizing that there is value to having different CRI levels in the marketplace.

The proposed efficacy levels would also provide the ENERGY STAR label only to the most energy efficient lamps, regardless of technology. As the Energy Commission's staff analysis demonstrates, LED to LED lamp savings from the Energy Commission's 2017 standard would yield a lifecycle savings per bulb of more than \$7 and a payback of about one year.² Moreover, the ENERGY STAR label will help consumers to properly

¹ Cal. Code Regs., tit. 20, § 1605.3(k)(2), Table K-9.

² Singh, Harinder, Ken Rider, 2015. Analysis of Small-Diameter Directional Lamp and General Service Light-Emitting Diode Lamp Efficiency Opportunities, California Energy Commission. Publication Number: CEC-400-

identify light bulbs that will save the most energy (and money), as well as help utility programs to design rebates and incentives around lighting products that will yield the most energy benefits. Both of these will help increase the marketshare of efficient LED lights ahead of the federal 45 lumen-per-watt backstop and drive down the first cost of the most efficient lamps as lighting manufacturers are able to achieve economies of scale.

The Energy Commission continues to encourage the U.S. EPA to look beyond the Energy Commission's proposed Tier 1 standards to achieve additional energy savings with high quality lamps. While the proposed levels are cost effective, more stringent levels are also highly cost-effective, as discussed in the Energy Commission's rulemaking documents.³ This includes considering higher efficacy standards (aligned with Tier 1) for directional and decorative lamps, which the Energy Commission's analysis show are cost-effective and technologically feasible.⁴

II. U.S. EPA should retain a power factor of at least 0.7.

The Interim Proposal proposes to lower the minimum power factor requirement for LED lamps to 0.5, consistent with the current requirement for CFLs. This level is unnecessarily low, particularly as there is no significant correlation between power factor and lamp price. The California investor-owned utilities investigated the correlation between price and many attributes of LED technologies in *LED Lamp Quality Codes and Standards Enhancement Initiative*, July 30, 2013, and found "correlated color temperature (CCT), lumen maintenance (L70), warranty length, and power factor did not demonstrate statistically significant independent influences on price after correcting for the influence of other factors."⁵

2015-034, p. 76, available at: http://docketpublic.energy.ca.gov/PublicDocuments/15-AAER-06/TN206387_20151016T152059_2015_Staff_Report_Analysis_of_SDDL_and_General_Service_LED_Lamp.pdf.

³ See proposed Tier 2 standards, *id.* at p. 57.

⁴ *Id.* at p. 76.

⁵ See, e.g., California IOUs Codes and Standards Enhancement (CASE) Initiative, LED Lamp Quality (July 29, 2013), at p. 79, available at http://energy.ca.gov/appliances/2013rulemaking/documents/proposals/12-AAER-2B_Lighting/PG_and_E_and_SDG_and_Es_Responses_to_the_Invitation_for_Standards_Proposals_for_LED_Quality_Lamps_2013-07-29_TN-71758.pdf. See also California IOUs Codes and Standards Enhancement (CASE) Initiative, LED Lamp Quality (Nov. 14, 2014), at p. 24, available at http://energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/2014-09-29_workshop/comments/California_IOUs_Response_to_the_CECs_Draft_Regulations_regarding_LED_Lamps_2014-11-18_TN-73993.pdf.

The U.S. EPA notes that power factor will not have an impact on the “consumer experience” and that stakeholders feel 0.5 power factor has been acceptable in CFLs. It is true that power factor is not directly related to the consumer experience. However, the impact of low power factor occurs at the utility. Although many utility customers are not charged directly for the reactive power caused by low power factor, every customer pays for the cost of grid infrastructure through increased electricity rates. The benefit and utility of higher power factor in LEDs is well outlined in the Edison Electric Institute’s comment to the U.S. Department of Energy regarding its rulemaking on general service lamps.⁶

The proposed reduction in LED power factor also creates unnecessary inconsistencies with existing specifications and approaches. The U.S. EPA’s recently adopted specification for luminaires requires a power factor of 0.7 for wattages greater than 5 watts. It is unclear why such a disparity would be warranted, especially when there are already a significant number of low cost ENERGY STAR LED lamps that have a power factor of 0.7 or higher. The Energy Commission supports higher power factor requirements and has proposed to incorporate the ENERGY STAR levels of 0.7 into its proposed minimum standards for general service LED lamps. The Energy Commission has also adopted a 0.9 power factor requirement in its Voluntary California Quality LED Lamp Specification, which is used by the California investor-owned utilities to structure lamp rebate programs.

III. U.S. EPA should retain existing omnidirectionality requirements for A-shape lamps.

The U.S. EPA should retain its luminous intensity distribution specifically for traditional A-shape lamps. LED A-shape lamps are not just replacement lamps, they are replacement lamps that are shaped in the same manner as the traditional incandescent lamp. The light distribution requirements in Lamps Specification v. 1.1 were already relaxed from the distribution expected of an incandescent A-lamp to establish levels consistent with the then-incumbent technology. The Energy Commission has already incorporated this approach in Version 1.1 into the California Building Energy Code, the proposed minimum efficiency standards for general service LEDs in California, and in the Voluntary California Quality LED Lamp Specification.

Lowering the first cost of A-lamps by allowing for lower quality lamps is unnecessary, as the price of A-shape lamps is already dropping significantly due to both decreases in

⁶ Comment letter is available online here <http://www.eei.org/issuesandpolicy/testimony-filings-briefs/Documents/140207RosenstockDoeGeneralServiceLamps.pdf>

component pricing and increases in marketshare.⁷ Moreover, omnidirectional light distribution continues to play an important part in consumer satisfaction when competing with incandescent lamps, which will remain a competitor until the federal general service lamp standards go into effect. To ensure that the market continues to move toward efficient LED products, the U.S. EPA should maintain its omnidirectional light distribution requirements for A-shape lamps.

The proposed changes to the omnidirectional luminous intensity distribution requirements would also apply to nontraditional omnidirectional lamp shapes. While medium screw base omnidirectional LED lamps come in many shapes and sizes, it is reasonable to believe that consumers would have different expectations regarding light distribution when the lamp shape is different. Therefore, the Energy Commission requests that changes to the luminous intensity distribution be limited only to those non-traditional shapes.

IV. U.S. EPA should further investigate test methods and metrics for rated life.

In the Interim Proposal, the U.S. EPA proposes to reduce the minimum rated life of ENERGY STAR lamps. The Energy Commission recommends that the U.S. EPA investigate other measures of lamp durability besides lumen maintenance L70 ratings. Currently the average warrantee period for ENERGY STAR qualified LEDs is less than that of CFLs. In addition, the Energy Commission has been made aware of poor quality driver components and less reliable capacitors that are being incorporated into LED lamps that are likely to be larger drivers of lamp failures than lumen depreciation.⁸ While the Energy Commission investigated additional tests and requirements to mitigate these low durability issues, it could not find a test or metric suitable for mandatory minimum proposed regulations. However, if high rated lifetimes in contrast with low actual lifetimes occur, it would tarnish the reputation of LED technology. We encourage the U.S. EPA to continue investigating this issue for this or the next version of the Lamps Specification.

V. Conclusion

The Energy Commission supports the U.S. EPA's efforts to improve the efficacy of lamps through a more stringent efficacy requirement tied to CRI. The Energy Commission encourages the U.S. EPA to continue to look beyond the Tier 1 levels being proposed in California to obtain greater energy savings and to ensure that the

⁷ See Singh, Harinder, Ken Rider, *supra*, p. 73 (cost breakdown for A19 replacement lamp).

⁸ See, e.g., Nov. 14, 2014 CASE Report, *supra*, at p. 15.

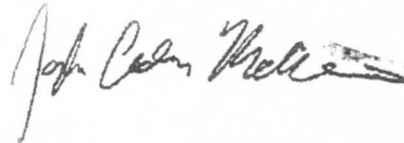
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ENERGY STAR program remains the recognized leader for highly efficient, high quality lamps in a rapidly evolving market.

The Energy Commission also recommends that the U.S. EPA retain its existing requirements for power factor and omnidirectional light distribution for A-shape lamps to ensure that consumers continue to have a positive experience with ENERGY STAR LED lamps. Positive consumer experience is critical to furthering the efforts to transform the market toward more efficient lighting technologies ahead of the federal general service lamp standards. Finally, we suggest continuing research into methods to ensure against early LED lamp failure.

If you have any questions about our comments, please contact Ken Rider, Associate Electrical Engineer, at (916) 654-5006, or Ken.Rider@energy.ca.gov. We look forward to continuing to support and to offer feedback to the U.S. EPA's ENERGY STAR program.

Sincerely,

A handwritten signature in black ink, appearing to read "John Andrew McAllister", written over a horizontal line.

J. ANDREW McALLISTER
Commissioner