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Color Rendering Index: the NEMA Lighting Industry Position

Introduction

The color rendering index (CRI) is a performance metric for lighting products that has generated much discussion in recent years. This discussion is moving into lighting efficiency policy discussions. The Lighting Systems Division of the National Electrical Manufacturers Association (NEMA) believes it would be incorrect and unfortunate for consumers, producers, and public policy to give too much weight to CRI in energy efficiency policy. This position paper explains why.

Background

At a technical level the Illuminating Engineering Society (IES),¹ defines the CRI value of a light source as a “measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference source of comparable color temperature.” In practical terms, CRI is a measure of how closely a light source reproduces the colors of a standardized set of 8 to 14 test color samples in comparison with an incandescent reference light source, or one which emulates a phase of daylight². In this sense, the Index is a comparator, indicating the *fidelity* with which a light source reproduces colors, again, in comparison to a reference light source. Importantly: it does not indicate the *preference* that people have for any light source in question.

CRI has entered energy efficiency policy discussions of late, in part because of a misconception that the closer a light source’s CRI value is to the CRI value of an incandescent lamp, the greater the expected level of consumer satisfaction with the light source. NEMA believes this perception is mistakenly arrived at, because incandescent light has its drawbacks too, and it is at times *not* selected as the preferred light source in direct comparison tests with light sources having more saturated light. Put another way, strictly copying or mimicking incandescent lighting performance requirements could lead to copying its deficiencies as well. It is worth mentioning that CRI was originally developed to evaluate fluorescent lighting and there are known deficiencies in applying the Index to solid-state lighting.

Numerous organizations, with members who are the scientific and engineering experts on the science of light, are speaking out against using high CRI requirements as a correlate of consumer satisfaction. Recently, LightingEurope issued a paper³ cautioning against high CRI requirements and affirming existing EU regulations which set the minimum at 80. Earlier this year, the IES issued a Position Statement⁴ cautioning against using CRI as a strict

¹ <http://www.ies.org/store/product/nomenclature-and-definitions-for-illuminating-engineering-br-rp1605-1013.cfm>

² See CIE 13.3-1995 (*Method of Measuring and Specifying Colour Rendering Properties of Light Sources*) for detailed information about CRI.

³ http://www.lightingeurope.org/uploads/files/LightingEurope_position_paper_on_color_quality_06102014.pdf

⁴ <http://www.ies.org/PDF/PositionStatements/PS-8-14.pdf>

metric for lighting regulations until the Society's Task Group has completed their work on new approaches to color metrics. A recent presentation by Yoshi Ohno of NIST⁵ indicates that optimally saturated CRI 75 light is equally preferred to CRI 93 light. The NEMA Lighting Systems Division adds its voice to the call for temperance in over-reliance on CRI as a guarantor of satisfaction.

Discussion

There is no evidence today to suggest that consumers demand or prefer a CRI value higher than 80 in general indoor illumination applications. It is worth pointing out that it is difficult for the human eye to distinguish the difference between CRI values that differ 5 points or less. A CRI value of 80 is common among high volume (i.e. well liked) high-efficiency lamps in the market today and is the current minimum threshold for numerous country- and regional-level regulations and incentive programs. The Alliance for Solid-State Illumination Systems and Technologies (ASSIST) as established in 2002 by the Lighting Research Center⁶ (LRC) recommends a minimum of CRI 80 (together with gamut area index, a measure of how saturated the light is, between 80 and 100) for its "Class A" rating of LED lamps. A 2014 study by Consumer Reports magazine indicates that CRI 80 is satisfactory for most indoor applications⁷. Lastly, in June 2014 the U.S. Environmental Protection Agency announced that they had met their 12-month challenge to sell 20 million ENERGY STAR certified LED bulbs⁸. Such a feat seems unlikely if consumers were not pleased with the products, and a review of the ENERGY STAR Lamps qualified products list reveals less than 3% of these lamps feature a CRI value of 90 or greater. This percentage is even lower if high-efficacy products are selected.

With respect to consumer preference, industry and consumer advocates have been working together for several years to educate consumers and increase awareness of the wider variety of choices now presented. The LUMEN Coalition⁹ is one good example of these efforts. Rather than limit flexibility and choice, we suggest that the issue of color is better addressed with consumer education than assuming high CRI is a guarantee of satisfaction or essential to all lighting applications. Supply and demand will achieve the right result for meeting consumer satisfaction; questionable regulatory requirements unrelated to energy efficiency will not.

Conclusion

NEMA joins with those cautioning against requirements of CRI above 80 for the purpose of regulatory or other minimum performance requirements. NEMA supports the importance of good color quality and encourages the ongoing work to develop new approaches to color metrics. A minimum threshold of CRI 80 provides flexibility and allows further innovation and price tradeoffs which will promote the continued evolution and adoption of LED lighting worldwide.

⁵ <http://www.cie-usnc.org/meetings/minutes-proceedings/technical-council-presentations-from-annual-meetings/>, p. 29

⁶ https://www.jstage.jst.go.jp/article/ilve/37/2_3/37_IEIJ130000501/article

⁷ <http://www.consumerreports.org/cro/lightbulbs/buying-guide.htm>

⁸ <http://www.energystar.gov/about/content/millions-energy-star-led-bulbs-sold-groundbreaking-u-s-challenge>

⁹ <http://lumennow.org/choosing-a-bulb/>