

Energy - Docket Optical System

From: Strait, Peter@Energy
Sent: Friday, February 27, 2015 8:45 AM
To: Energy - Docket Optical System
Cc: Shirakh, Maziar@Energy; Lee, Simon@Energy
Subject: RE: 14-BSTD-01; 2016 Building Standards Update
Attachments: Letter to Commissioner McAllister about IES PS-8-14.pdf

California Energy Commission

DOCKETED

15-BSTD-01

TN # 74854

FEB 27 2015

Hello Dockets,

Please also docket the letter under 15-BSTD-01, as it appears intended to apply to the Rulemaking rather than the pre-rulemaking period.

Thank you,

Peter

From: Konstantinos Papamichael [<mailto:kpapamichael@ucdavis.edu>]
Sent: Friday, February 27, 2015 7:25 AM
To: Energy - Docket Optical System
Cc: Shirakh, Maziar@Energy; Lee, Simon@Energy; Strait, Peter@Energy; Saxton, Patrick@Energy; Taylor, Gabriel@Energy; Parrow, Donna@Energy
Subject: 14-BSTD-01; 2016 Building Standards Update

The attached letter is to inform you about serious concerns of nine professionals with expertise related to human vision and illumination about the IES Position Statement 8-14 against using the Color Rendering Index (CRI) metric in energy regulations.

We hope that the information provided will contributed to better-informed decisions on current and upcoming energy regulations.

Sincerely,

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Konstantinos Papamichael, Ph.D.
Professor, [Department of Design](#)
Co-Director, [California Lighting Technology Center](#)
[University of California, Davis](#)
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Department of Design
California Lighting Technology Center (CLTC)

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February 26, 2015

Commissioner Andrew McAllister
California Energy Commission
1516 Ninth Street, MS-31
Sacramento, CA 95814

Regarding: Serious Concerns Related to the IES Position Statement 8-14 on "Color Rendering Index"

Dear Commissioner McAllister,

Attached please find a letter that was sent to the Board of Directors (BOD) of the Illuminating Engineering Society (IES), requesting immediate withdrawal of the recently issued IES Position Statement PS-8-14, "Color Rendering Index", which recommends exclusion of the current Color Rendering Index (CRI) metric from energy regulations.

We understand that recently certain manufacturers who have been arguing against the California LED Lighting Specification have sent cited copies of IES PS-8-14 as a justification for their position. Moreover, during the last Title 20 workshop held at the California Energy Commission (CEC) on September 29, 2014, they used IES PS-8-14 to argue against CRI consideration in Title 20.

In its current form PS-8-14 leaves completely open what metric (if any) should be used for characterizing solid-state light sources regarding color-rendering requirements. This unclear position allows the statement to be misconstrued to suggest that color rendering requirements are not important when it comes to light sources. Those in the industry know from firsthand experience that this is not the case when it comes to adoption (e.g., compact fluorescent light sources), which is why California has adopted stringent color rendering requirements in its Voluntary Lamp Specification (CEC-400-2012-016-SF CA Voluntary Lighting Spec). Ignoring color requirements in energy regulations would be a big step backwards, confusing to stakeholders, and potentially harmful to realizing the energy savings possible through widespread adoption of efficient lighting products.

Since the IES Board has yet to take any corrective action in response to our letter, we feel obligated to inform you that, contrary to the usual meaning of the term Position Statement, IES PS-8-14 does not represent the views of the Illuminating Engineering Society. The IES BOD has acknowledged to us that PS-8-14 is only a "consensus opinion of the Board members", and that is has not received widespread technical support from the society's members. For example, the IES Color Committee was not consulted during its preparation, and the members of the IES had no opportunity to review or comment before PS-8-14 officially issued by the Board.

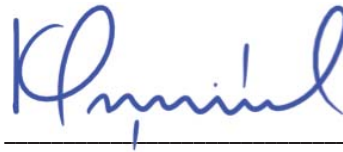
We firmly believe that the PS-8-14 is conceptually flawed, and has the potential to cause serious harm. We have respectfully asked the IES BOD to immediately withdraw it and to then thoughtfully prepare a new version that is technically accurate and represents the collective consensus of knowledgeable IES members rather simply the isolated opinion of IES Board Members, especially because they were not elected to opine on matters of this sort without seeking a consensus of scientifically knowledgeable members. For these reasons, we sincerely advise you to simply disregard IES PS-8-14 and instead consult as needed with acknowledge scientific experts.

Of course, we will be happy to answer any questions you may have.

Sincerely,



Professor Michael Siminovitch
Co-Director, CLTC, University of California, Davis



Professor Konstantinos Papamichael,
Co-Director, CLTC, University of California, Davis



Professor Lorne Whitehead, University of British Columbia

Board of Directors
Illuminating Engineering Society
120 Wall Street
Floor 17
New York, NY 10005-4001

Sent via e-mail, in response to an invitation from IES President Paul Mercier

September 23, 2014

Re: Serious Concerns with IES Position Statement 8-14

Dear Board Members,

The undersigned are professionals with expertise related to human vision and illumination. We are writing to express serious concern about recently issued IES Position Statement 8-14. We believe that in its current form it is unclear and may in fact cause serious harm.

In its current form PS-8-14 leaves completely open what metric (if any) should be used for characterizing solid-state light sources regarding color rendering requirements. This unclear position allows the statement to be misconstrued to suggest that color rendering requirements are not important when it comes to light sources. Those in the industry know from firsthand experience that this is not the case when it comes to adoption (e.g., compact fluorescent light sources), which is why California has adopted stringent color rendering requirements in its Voluntary Lamp Specification (CEC-400-2012-016-SF CA Voluntary Lighting Spec). Ignoring color requirements in energy regulations would be a big step backwards, confusing to stakeholders, and potentially harmful to realizing the energy savings possible through widespread adoption of efficient lighting products.

Furthermore, while the current color fidelity metric (the CRI, aka the CRI General Color Rendering Index Ra, or simply Ra) does have shortcomings, it is certainly better than no metric at all. In particular, the use of additional Munsell samples to more fully describe color fidelity properties is one way to reduce the kind of "gaming" that can be applied to Ra alone. For example, the addition of R9 is already well known, and often used, to help in discriminating between light sources in terms of color fidelity.

We therefore believe the IES has an obligation to promptly announce it will be preparing an amendment of PS-8-14, in response to concerns it has received. The amendment should make it clear that:

- 1) Color fidelity requirements are an important aspect of lighting and should be considered in energy regulation
- 2) The IES is far along on an improved color fidelity metric
- 3) Until the new metric is accepted, color fidelity requirements should be specified by a combination of the existing CRI metric (Ra) and R9

The reasoning behind this view is set out in detail in the attached appendix. We would also be pleased to provide assistance, at your request, in developing the requested amendment.

In the absence of an announcement along the above lines, the undersigned, (and likely many others), will have a duty to publicly notify regulators and other key decision-makers about their disagreement with the current version of PS 8-14. We would strongly prefer not to do that, recognizing that it could inadvertently undermine the credibility of the IES and be disruptive to the industry in general. We would strongly prefer to cooperate in order to avoid that outcome.

Because of the urgency of this matter, we respectfully request a prompt response to this letter.

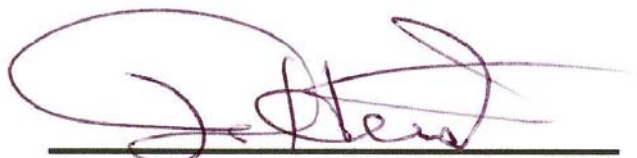
Sincerely,



James Benya
Principal
Benya Burnett Consultancy



Greg Merritt
Vice President, Marketing and Public Affairs
Cree, Inc.



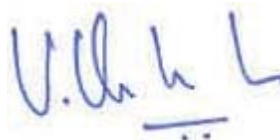
Doug Herst
Founder and Executive Chairman
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Michael Siminovitch
Professor
University of California, Davis



Michael Krames
Chief Technology Officer
Sora, Inc.



Venkat Venkataramanan
Professor
University of Toronto



Jim Larimer
Former Director of NSF's Sensory Physiology
and Perception Program



Lorne Whitehead
Professor
University of British Columbia



Konstantinos Papamichael
Professor
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Appendix A. Outline of Concerns with IES Position Statement 8-14, “Color Rendering Index”

Below, the language from IES Position Statement 8-14 is presented in *italic font*, and interspersed are statements of concern regarding the current wording.

*IES PS-8-14: The IES recognizes that the Color Rendering Index (CRI) metric, used to determine the accuracy of a light source’s rendition of color compared to a reference, has shortcomings that limit its ability to **fully represent how humans perceive color**.*

Science concerns: This sentence contains the built-in false assumption that the intention of the CRI has been to “fully represent how humans perceive color”. That has never been its intention, and for that matter it is not clear what it would actually mean to “fully represent how humans perceive color”.

The CRI has always been clearly documented as having one clear purpose - to provide a measure of the accuracy with which a light source causes objects to have the same color appearance as they do under the natural reference light sources of black-body radiators or daylight, depending on the color temperature. This concept, which for clarity is often called color fidelity, is very important for three reasons:

1. Color fidelity is useful – it enables people to accurately assess the color of an object in order to learn something useful about it in reference to past experience – for example does a person have a healthy complexion, is a piece of meat fresh, is a banana ripe, is a bun moldy, etc. A lack of color fidelity can cause errors in such judgments about objects.
2. Color fidelity maintains the integrity of color design. A lack of color fidelity can cause objects whose color appearances were matched under a natural reference illuminant to no longer match, and can also distort the manner in which two or more colors harmonize as envisioned by the designer.
3. An absence of color fidelity may cause colors to look “unnatural” to some observers, sometimes causing them significant discomfort.

From this perspective, the CRI achieves its purpose very well, although not quite well enough for certain lamp spectral power distributions. Specifically, it is currently possible to “game” the CRI by careful adjustment of narrow spectral peaks, in order to slightly boost the CRI Ra score higher but without actually improving the apparent color fidelity.

A completely different topic is what is sometimes called “color preference”, an idea that relates to the highly subjective field of color aesthetic judgments. It is well known that if subjects are shown a number of light sources, each with different SPDs but with the same low CRI value (say about 75), most subjects will find some sources preferable to others. Many people feel that such aesthetic preferences are important and should be studied, and research is underway in that extremely complex field. The results will almost certainly depend on many variables, such as the setting and the individual preferences of the observer, which vary considerably. The degree of subjectivity makes the field of “color preference” very different than the subject of “color fidelity”, which by comparison is highly objective – generally people are quite similar in their assessment of whether two objects have the same color appearance.

Interestingly, while “color preference” is a highly subjective topic, its study can nevertheless benefit from the use of objective measures, several of which are investigation. It is unlikely that any single metric will be uniquely valuable in this

complex field, and it is virtually certain that no set of metrics will ever “fully represent how humans perceive color”.

However, when it comes to the objective issue of color fidelity, a combination of CRI and R9 would do well to assure that good color fidelity is achieved, until an improved and industry-ratified metric is achieved.

IES PS-8-14: Since its adoption in 1964, several light source technologies have been introduced and commonly adopted for architectural lighting that yield a different visual experience than the CRI metric can describe.

Science concerns: This language has a built-in false assumption – it implies that the CRI metric is intended to describe “visual experience”. This muddles color fidelity (for which the CRI is a very good but not yet perfect measure) with other color aesthetic effects with which the CRI has no connection.

IES PS-8-14: To this end, the Illuminating Engineering Society (IES) formed a Color Metric Task Group in March 2013, which has been tasked to develop an improved measure to characterize light source color rendition. This group is committed to developing an alternative to CRI that will better serve the lighting industry and its stakeholders.

The task group is currently writing an IES Technical Memorandum (TM) that may propose a path toward a new color metric.

Science concerns: Based on discussions with members of this task force, this is a misleading characterization of it. It is planning (in informal coordination with the CIE Technical Committee 1-90) to recommend an adjustment to the current CRI, with the main effect simply being to slightly lower the scores for the problematic SPDs mentioned above, and in addition to that to recommend a second metric for characterizing the patterns of color distortions that will occur when using lamps that have imperfect color rendering. In other words, the anticipated output from that committee will be synergistic and collaborative with the CIE, providing an improved accuracy for the CRI and also providing one or more additional measures that will provide useful additional information for color preference studies and recommendations.

*IES PS-8-14: In recognition of the shortcomings and limitations of the current CRI metric and the development of a new TM addressing color metrics, it is the position of the IES that **CRI requirements should not be a metric used in energy regulations** to characterize color attributes for solid state lighting **until there is industry consensus on the issue.***

Science concerns: This last sentence has three basic problems:

1. The statement that “CRI requirements should not be a metric used in energy regulations”, if followed, would result in energy regulations lacking a minimum required CRI value. In other words, the regulations could be met without consideration of CRI. Since it is slightly less expensive to make and power low CRI lamps, the absence of a CRI requirement will economically incentivize low CRI lighting. That would be harmful to human well-being, because color fidelity is far more important to the quality of human vision than illuminance. (For example 60fc at 90CRI provides excellent visual experience in an office, yet 90fc at 60CRI is completely unacceptable.)

2. According to the wording, this recommended non-use of CRI would persist for an unknown length of time – “until there is industry consensus on this issue”, and moreover there is no definition of what would constitute “industry consensus” or what “the issue” actually is.
3. The current Position Statement lacks a summary of the advantages and disadvantages to be expected if people were to follow, or not follow, its recommendation. In this case, we believe such an analysis would show that abandoning the CRI for its intended use could cause serious harm, whereas continuing to use it for its intended use, while improvements are being brought developed, could cause, at worst, only occasional minor inconvenience.