

## DOCKETED

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**Proposed maximum Correlated Color Temperature (CCT) for outdoor lighting**

*Additional submitted attachment is included below.*



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Proposed maximum Correlated Color Temperature (CCT) for outdoor lighting

At the February 6, 2018 45-day Language Lead Commissioner Hearing, the staff made presentations on proposed changes to CalGreen. The proposed changes include adding the underlined language in the following subsection:

**[Appendix A5] A5.203.1.1.1 Outdoor lighting.** Newly installed outdoor lighting power shall be no greater than 90 percent of the Allowed Outdoor Lighting Power, and shall have a color temperature no higher than 3000K. The Allowed Outdoor Lighting Power calculation is specified in Title 24, Part 6, Section 140.7 “Requirements For Outdoor Lighting.”

The rationale presented for adopting a maximum CCT of 3000K (3000 Kelvin) is based upon recommendations in a report (Report) by The American Medical Association.<sup>i</sup>

According to the Lighting Research Center (LRC) at Rensselaer Polytechnic Institute,<sup>ii</sup> it is not appropriate to establish a CCT standard for outdoor lighting as a means to address the health concerns raised by the Report. Following is an excerpt from the LRC comments.

Lighting metrics have been developed and commonly used to predict biological responses to physical characteristics. Metrics are intended to be short-hand simplifications for characterizing a particular stimulus-response relationship. Correlated color temperature (CCT) for example is a simplification of the light source spectral power distribution (SPD) to represent how people will see the tint of illumination from that source (i.e., “warm” or “cool”). The CCT metric ignores nearly all of the important factors associated with light exposure (amount, duration, timing) and is only relevant to a single biological response (perceived tint of illumination). Therefore, CCT should never be used to characterize light as a stimulus for, say, blue light hazard. As a further example, the non-linear response of the human circadian system to white light indicates that for the same corneal photopic illuminance and depending on the SPD of the source, a 3500 K source can produce greater melatonin suppression than a 5000 K source. In general then, it is erroneous and misleading to use a metric developed for one purpose and then apply it to another purpose, particularly with regard to the impact of light on human health.

Also, it is not correct to apply a maximum outdoor lighting CCT for on-site lighting based upon the Report because it specifically addresses “Community Lighting,” which is described in the report as street lighting. The proposed CalGreen language cites Title 24, Part 6, Section 140.7, which does not regulate street lighting, but regulates on-site lighting. The Report does not make recommendations for on-site lighting.

Although requirements in CalGreen Appendix A5 are classified as “Nonresidential Voluntary Measures,” it is expected that a significant number of local jurisdictions will adopt some or all of the voluntary measures as mandatory. Therefore, it should be recognized that this proposed language will become a mandatory measure in a number of different areas.

The Report recommends, “In environmentally sensitive or rural areas where wildlife can be especially affected (e.g., near national parks or bio-rich zones where nocturnal animals need such protection), strong consideration should be made for lower emission LEDs (e.g., 3000K or lower lighting with effective shielding.” Therefore, it may be environmentally sensitive for California to address the concerns raised in the Report in outdoor Lighting Zones (LZ) LZ0, LZ1, and LZ2. The five outdoor lighting zones are built primarily around population densities, as follows:

LZ0 - Very Low - Undeveloped areas of government designated parks, recreation areas, and wildlife preserves.

LZ1 – Low - Developed portion of government designated parks, recreation areas, and wildlife preserves.

LZ2 – Moderate - Rural areas, as defined by the 2010 U.S. Census.

LZ3 - Moderately High - Urban areas, as defined by the 2010 U.S. Census.

LZ4 – High – None – Local AHJ must process and submit a request to CEC

It has been posited for years that blue rich light sources increase visual acuity in the mesopic visual range, particularly for aged eyes with cataracts and yellowing lenses. Following is a summary of the three visual ranges:

Photopic vision<sup>iii</sup> is vision under well-lit conditions, which provides for color perception.

Mesopic vision is a combination of photopic vision and scotopic vision in low lighting.

Scotopic vision is monochromatic vision in very low light.

Finally, in California, highway lighting is administered by the California Department of Transportation (CalTrans). Other public street lighting is administered by a number of different public entities. Senate Bill 5X (Statutes of 2001) requires the California Energy Commission to consult with Caltrans when adopting changes to outdoor lighting. Although it is understood that Senate Bill 5X gives authority to the California Energy Commission (CEC) to regulate public street lighting, the CEC has never conducted a rulemaking proceeding to regulate public street lighting. I have seen no evidence that the proposed AMA recommendations for street lighting have been vetted with Caltrans.

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<sup>i</sup> REPORT OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH; CSAPH Report 2-A-16; Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting; Presented by Louis J. Kraus, MD, Chair; Referred to Reference Committee E (Theodore Zanker, MD, Chair).

<sup>ii</sup> Response to the American Medical Association (AMA) report, June 30, 2016; "Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting," Mark S. Rea, PhD and Mariana G. Figueiro, PhD of the Lighting Research Center at Rensselaer Polytechnic Institute. <http://www.lrc.rpi.edu/resources/newsroom/AMA.pdf>

<sup>iii</sup> <http://www.innovativelight.com/photopic-scotopic-vision/>