

## DOCKETED

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*Comment Received From: Pete Strasser*

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**Approve 3000K as Maximum CCT Value for LEDs**

*Additional submitted attachment is included below.*

The International Dark-Sky Association supports the decision to specify LEDs with a Correlated Color Temperature (CCT) of 3000 K or less, and to limit IES TM-15 Glare ratings to G2 or below. These recommendations will meet the following goals:

1. Minimize light pollution and sky glow. The blue, short wavelength component of the light emitted by high brightness white LEDs causes significant sky glow. As a general rule, warmer LEDs of 3000K or lower emit less of the problematic wavelength. Contemporary LEDs of 3000k or lower have similar efficacy to 4000k, making the decision to utilize them moot with respect to economic necessity.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0067798>

<https://academic.oup.com/mnras/article/415/4/3609/1749164>

<https://www.sciencedirect.com/science/article/pii/S0022407313004792>

2. Minimize environmental impact on the ecology. The nocturnal habitat shows significantly disruption when exposed to a greater amount of shorter wavelength light. Less harm can come to these when warmer CCT LEDs are used.

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0067798>

<https://www.sciencedirect.com/science/article/pii/S0022407313004792>

3. Minimize human exposure to short wavelength light. Numerous studies indicate the potential harm done to humans when exposed to this. No compelling reason now exists to use LEDs colder than 3000K. The AMA made such a recommendation in June of 2106, by a vote of 535 to 0 in favor. This is the official position of their House of Delegates, and was reaffirmed in 2017. There has been some pushback from the lighting industry, yet none of them have refuted their findings and instead dwell upon the use of a poor metric (Correlated Color Temperature) to convey short wavelength emission values, the very metric the industry has used themselves for years.

<https://www.ama-assn.org/sites/default/files/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/a16-csaph2.pdf>

<https://www.ncbi.nlm.nih.gov/pubmed/11507175>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2831986/>

<http://onlinelibrary.wiley.com/doi/10.1111/jpi.12221/full>

### 3. Provides higher visual quality (less glare)

According to IEEE research on dark adaptation using LEDs with different CCT, as CCT increases, dark adaptation time increases. High CCT LED light source, which has a relatively high amount of blue light components, has the longest dark adaptation time. On the other hand, warm white LEDs have a relatively low CCT and a high amount of long wavelength components, and they have short dark adaptation times. Also, as road illuminance increases, dark adaptation time increases as well.

The test on fog penetration shows that as fog or haze level increases, road illuminance decreases, which means light's transmission through fog or haze decreases. Higher CCT is correlated to lower transmission in fog or haze. When using LEDs for road lighting, the human eye has decent dark adaptation time and color discrimination abilities under streetlights of around 3000 K CCT. LED light of 3000 K CCT also has a relatively high luminous efficacy, and is suitable for road lighting while reducing glare.

<http://ieeexplore.ieee.org/stamp/stamp.jsp?reload=true&arnumber=7328247>

4. Provide higher community acceptance of outdoor lighting. Changing a technology that has about 5 decades of familiarity no doubt creates problems for the people exposed to the new condition. There is an increasing number of communities that have installed or planned to install LED streetlights colder than 3000K, only to discover the profound dislike among the populace, to the point of replacement and change in product selection. Included are the city of Davis, CA, Phoenix, AZ, Montreal, Canada, the LED lighting controlled by Georgia Power.

<https://www.phoenix.gov/news/mayor/1575>

<http://www.cbc.ca/news/canada/montreal/montreal-led-streetlights-1.3940889>

[http://www.iesmission.org/IES%20PDF%20Meetings/PDF 2016/Davis%20LED%20Retrofit%20Shows%20Need%20For%20Careful%20Lighting%20Choices.pdf](http://www.iesmission.org/IES%20PDF%20Meetings/PDF%202016/Davis%20LED%20Retrofit%20Shows%20Need%20For%20Careful%20Lighting%20Choices.pdf)

Given these arguments, there is no compelling reason to specify LEDs with a colder CCT than 3000k.