Occupant response to different correlated colour temperatures of white LED lighting

Correlated Colour Temperature (CCT) of lighting may affect not only occupant visual perception, but also other indoor environment perceptions, such as perceptions of the thermal environment or the air quality. This study aimed at quantifying the association between CCT of white LED lighting and subjective perceptions and performance at operative temperatures at the upper and lower borders and in the middle of the comfort range. Higher CCT was significantly associated with decreasing thermal sensation, but only at the thermally neutral condition. Female subjects responded stronger to changes in CCT than male subjects. Under all temperature conditions, CCT was clearly associated with the perceived brightness of the light, and at 22 °C also with the perceived air quality and with subjectively assessed alertness. CCT had no effect on the measured performance of a d2 task. At 22 °C, the observed decrease in thermal sensation when CCT went from 2700 K to 6200 K was equivalent to a difference in operative temperature of 1.7 °C. With an assumed neutral CCT of 4500 K (middle of range), a decreased heating set point in an office building, corresponding to an equivalent shift in CCT from 4500 K to 2700 K, resulted in a reduction of around 8% of the building's total annual energy use. However, this assumes ideal conditions without influence from daylight, light from PC monitors, or coloured surfaces and other potentially disturbing factors.

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