

C-9a: Reduce retail display lighting allowance (C405.4.2.2.1)

Summary: Reduce the display lighting extra power allowance for specialty sales. This allowance is provided for retail display lighting that has historically been incandescent or ceramic metal halide (CMH). New LED fixtures can provide similar display lighting with lower energy use. Extra allowances for retail areas 1, 2, and 3 are reduced by 40% and retail area 4 (jewelry, crystal and china) is reduced by 25%. LEDs are intrinsically more efficient than the incandescent or CMH lamps that have traditionally been used for display lighting. Reduced display lighting allowances will move many designers to use the more efficient lighting source in these applications. This change will result in significant savings in retail buildings where lighting is a large share of overall energy use.

DOE proposal C-9 was replaced with revised proposals C-9a and C-9b on December 18, 2015.

Stakeholder Feedback: There were approximately 71 public comments received for proposal C-9, many of them similar. All the comments for the original C-9 proposal are included here for clarity, even though C-9 was subsequently split into two proposals in response to comments. Comments are summarized below, followed by a DOE review:

- Approximately 59 comments indicating the retail display lighting reduction should not be 50%, 45 of which suggested reductions in the 25% to 30% range would be acceptable.
Review: A reduction of 50% or more for retail display lighting was shown to be cost-effective; however, based on the number of comments, the reduction can be smaller than originally proposed for this code cycle as a phase-in strategy. Further reductions can be made in the future, when LED fixtures are more commonly used.
- Four comments concerned with quality of the LED lighting in certain instances.
Review: LED fixtures are available in a wide range of color temperatures and beam characteristics, and by the time the 2018 IECC is adopted, it is reasonable to assume that there will be more variation in product available, based on current market trends.
- One comment requesting information that changes in LPD allowances would still allow fluorescent and CMH lamp types.
Review: An LPD allowance based solely on LEDs would be even lower, so a mix of other lamp types will be allowed under the proposal.
- One comment that decorative lighting was not discussed in the reason statement and that the proposal title appeared to be restricted to retail lighting.
Review: The analysis focused on retail display lighting, but the approach applies equally to art and architecture display lighting that is part of the decorative lighting in exception 2. The word “retail” was not used in the title. The proposals have been split to clarify the approach.

- Approximately 69 comments indicating the decorative allowance should not be reduced, as it is a specific allowance that cannot be used for general lighting and the base LPDs consider the availability of the decorative allowance.

Review: The decorative allowance is equal to or greater than the base LPD allowance in many cases, and that decorative lighting can benefit from newer, more efficient LED technology. DOE does not agree that the decorative allowance should remain at the current level, as many decorative lighting uses can benefit from newer and more efficient LED technology. In response to the many comments on this issue, DOE is revising its proposal to call for a smaller reduction in the decorative lighting allowance.

In response to these comments, DOE will not discontinue its proposals related to display lighting, but has revised its lighting allowance proposal by separating the retail display lighting (now proposal C-9a) from the decorative and art display lighting allowance (now proposal C-9b) proposal. Further, the proposed reductions have been relaxed as follows:

- For retail lighting in areas 1, 2, and 3, a reduction of 40% rather than 50% is proposed (Proposal C-9a).
- For retail lighting in area 4, a reduction of 25% rather than 36% is proposed (Proposal C-9a).
- For decorative lighting in general, a reduction of 25% rather than 50% is proposed (Proposal C-9b).
- For decorative lighting in lobbies and museum exhibition areas, a reduction of 10% rather than 50% is proposed (Proposal C-9b).

=== IECC PROPOSAL:

Modify Section 405.4.2.2.1 as follows:

405.4.2.2.1 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and automatically controlled separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases:

1. For lighting equipment to be installed in sales areas specifically to highlight merchandise, the additional lighting power shall be determined in accordance with Equation 4-10.

$$\text{Additional interior lighting power allowance} = 500 \text{ 300 watts} + (\text{Retail Area 1} \cdot 0.6 \text{ 0.36 W/ft}^2) + (\text{Retail Area 2} \cdot 0.6 \text{ 0.36 W/ft}^2) + (\text{Retail Area 3} \cdot 1.4 \text{ 0.84 W/ft}^2) + (\text{Retail Area 4} \cdot 2.5 \text{ 1.87 W/ft}^2)$$

(Equation 4-10)

where:

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.

Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.

Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.

Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.

Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the code official.

2. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance or for highlighting art or exhibits, provided that the additional lighting power shall be not more than 1.0 w/ft² of such spaces.

Reason: The code allows additional lighting wattage for display lighting in retail areas to acknowledge the need for bright merchandise lighting. This proposal reduces that allowance based on providing equivalent lighting

levels with newer light emitting diode (LED) lamp technology. A large portion of retail display lighting that is eligible for the additional allowances typically uses Halogen MR-16 lamps. The LED market has been working steadily to enter this area. In 2012, there were many effective products but they were not robust enough to replace the higher wattage (50W) MR-16 products. As of 2014 and beyond, this has changed. There are now many products covering the spread of the capabilities of the 20W to 50W Halogen MR-16s. LED offerings are effective direct replacements for retail display Halogen. Information from recent reports¹ shows that LED could provide similar light at approximately 30% of the existing Halogen wattage or a 70% reduction. A more conservative approach is taken in this proposal, with a 50% reduction in the general display allowance and a 25% reduction in retail area 4.

Energy Savings: While there is a high variation in how different retail establishments apply display lighting, an analysis of the DOE strip mall prototype² for the impact of the proposed savings shows annual energy cost savings of 2.7% per year or around \$850 for a 22,500 square foot establishment. This electric cost savings is in addition to the lamp replacement cost savings from using longer life LEDs.

The U.S. Department of Energy (DOE) develops its proposals through a public process to ensure transparency, objectivity and consistency in DOE-proposed code changes. Energy savings and cost impacts are assessed based on established methods and reported for each proposal, as applicable. More information on the process utilized to develop the DOE proposals for the 2018 IECC can be found at: <https://www.energycodes.gov/development/2018IECC>.

Cost Impact: The LED fixtures for use in display light fixtures provide more lighting output at a lower energy use. LEDs have a higher cost per lamp, but their expected life is longer, so their overall cost is lower. A survey of typical lamps in the 200 to 800 lumen output range is shown in the following table, based on a review of online lamp prices from a national maintenance product supplier.

	Lumen Output	Cost per lamp	Life, hours MTBF	Lamp cost, \$/3000 hours	\$/500 lumens /3000 hours	\$/500 lumens /3000 hours Limited to 5 year use
MR-16 lamp						
Halogen	200	\$3.33	3,000	\$3.33	\$8.33	\$8.33
Halogen	400	\$3.08	1,971	\$4.69	\$5.86	\$5.86
Halogen	500	\$15.31	3,000	\$15.31	\$15.31	\$15.31
Halogen	790	\$6.47	3,000	\$6.47	\$4.09	\$4.09
Average Halogen		\$7.05		\$7.45	\$8.40	\$8.40
LED	450	\$16.25	25,000	\$1.95	\$2.17	\$3.61
LED	370	\$37.00	25,000	\$4.44	\$6.00	\$10.00
LED	650	\$35.00	30,000	\$3.50	\$2.69	\$5.38
Average LED		\$23.82		\$3.30	\$3.62	\$6.33
Ratio of LED to Halogen lamp cost				44%	43%	75%

LED prices are expected to continue to decrease, and will be lower by the time this code is adopted. Lamp costs are normalized to 500 lumens of output and 3000 hours of operation a year or about 10 hours per day for 6 days a week. The last column in the table is the lamp cost per 500 lumens per 3000 hours, but limits the LEDs to 5 years of use at 3000 hours per year. In both the full life and conservative 5-year case, the average lamp cost for LEDs is

¹ http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/snapshot2014_mr16.pdf
& http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/caliper_22_summary.pdf

² The DOE prototypes represent typical U.S. building stock and the building energy use is simulated in EnergyPlus. See more information about the prototypes at: <https://www.energycodes.gov/commercial-prototype-building-models>.

less once lamp life is considered. The costs shown do not include additional lamp replacement labor savings or any reduction in electrical distribution costs due to lower wattage lamps. From several points of view, the use of LED fixtures for display lighting represents a reduction in life cycle lamp costs to building owners.

Cost-effectiveness: This change is cost-effective in that it provides significant savings with no anticipated life-cycle cost increase.