

IECC®: C405.2.5

Proponents:

Glenn Heinmiller, representing International Association of Lighting Designers (glenn@lampartners.com)

2021 International Energy Conservation Code

Revise as follows:

C405.2.5 Specific application controls.

Specific application controls shall be provided for the following:

The following lighting shall be controlled by an occupant sensor complying with Section C405.2.1.1 or a time-switch control complying with Section C405.2.2.1. In addition, a manual control shall be provided to control such lighting separately from the general lighting in the space:

- 1.1. Luminaires for which additional lighting power is claimed in accordance with Section C405.3.2.2.1.
- 1.2. ~~Display and accent lighting~~ **Display and accent lighting, including lighting in display cases**
1. ~~1.3. Lighting in display cases.~~
- ~~1.4~~ **1.3.** Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.
- ~~1.5~~ **1.4.** Lighting equipment that is for sale or demonstration in lighting education.
- ~~1.6. Display lighting for exhibits in galleries, museums and monuments that is in addition to general lighting.~~

Sleeping units shall have control devices or systems that are configured to automatically switch off all permanently installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.

Exceptions:

2.
 1. Lighting and switched receptacles controlled by card key controls.
 2. Spaces where patient care is directly provided.
3. Permanently installed luminaires within *dwelling units* shall be provided with controls complying with Section C405.2.1.1 or C405.2.3.1.
4. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a time switch control complying with Section C405.2.2.1 that is independent of the controls for other lighting within the room or space.
5. Task lighting for medical and dental purposes that is in addition to *general lighting* shall be provided with a *manual control*.

Reason Statement:

This proposal simplifies and clarifies the requirements by eliminating redundancy and unclear terminology. Three related types of lighting are consolidated under one type: "Display lighting"

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This is a simplification for clarity and does not change code requirements.

CEPI-168-21

CEPI-184 Mod:

IECC Proposal Additional Lighting Power

C405.3.2.2.1 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 controlled in accordance with Section C405.2.5. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. ~~This additional power shall be permitted only in the space for which it is claimed and may not be added to the interior power allowance for other spaces.~~ 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 4-11.

<p>Additional interior lighting power allowance = $1000 \text{ W} + (\text{Retail Area 1} \times 0.45 \text{ W/ft}^2) +$ $(\text{Retail Area 2} \times 0.45 \text{ W/ft}^2) + (\text{Retail Area 3} \times$ $1.05 \text{ W/ft}^2) + (\text{Retail Area 4} \times 1.87 \text{ W/ft}^2)$ For SI units: Additional interior lighting power allowance = $1000 \text{ W} + (\text{Retail Area 1} \times 4.8 \text{ W/m}^2) +$ $(\text{Retail Area 2} \times 4.84 \text{ W/m}^2) + (\text{Retail Area 3}$ $\times 11 \text{ W/m}^2) + (\text{Retail Area 4} \times 20 \text{ W/m}^2)$</p>	<p>(Equation 4-11)</p>
<p><u>Additional Lighting Power Allowance =</u> $500 \text{ W} + (\text{Retail Area 1} \times 0.40 \text{ W/ft}^2) +$ $(\text{Retail Area 2} \times 0.40 \text{ W/ft}^2) + (\text{Retail Area 3} \times 1.0 \text{ W/ft}^2) +$ $(\text{Retail Area 4} \times 1.2 \text{ W/ft}^2)$ <u>For SI Units</u> <u>Additional Lighting Power Allowance =</u> $500 \text{ W} + (\text{Retail Area 1} \times 4.3 \text{ W/m}^2) +$ $(\text{Retail Area 2} \times 4.3 \text{ W/m}^2) + (\text{Retail Area 3} \times 11 \text{ W/m}^2) +$ $(\text{Retail Area 4} \times 13 \text{ W/m}^2)$</p>	<p>(Equation 4-11)</p>

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 ~~0.9~~ 0.45 W/ft² (~~9.7~~ 4.8 W/m²) in ballrooms, beauty & spa, casinos, facilities for the visually impaired, leisure dining, lobbies, performing arts, retail sales, religious worship and not more than ~~0.75~~ 0.25 W/ft² (~~8.1~~ 2.7 W/m²) in other spaces. This additional power shall be permitted only in the space for which it is claimed and may not be added to the interior power allowance for other spaces.

3. In facilities for the visually impaired, spaces with transition lighting that is turned OFF at night by astronomical time clock, the wattage of the controlled lighting power up to 0.90 W/ft² of additional power is allowed for areas within 30 feet of an exit that is not in a skylight daylit zone or a sidelit daylit zone

Reason

- This proposal provides sufficient decorative and retail lighting additional lighting power to develop beautiful lighting designs that enhance the built environment while limiting energy waste and helping preserve resources and the global environment
- This proposal will reduce costs initially and over the life of the lighting system.
- Reduced lighting power results in less wattage of luminaires installed and reduced electrical operating cost. Payback is instantaneous.
- This proposal will reduce the amount of environmental pollution associated with operating electric lighting.

The IECC decorative allowance of 0.75 W/ft² is the same as the decorative allowance in ASHRAE 90.1-2019, except for one space type; the IECC allows a decorative allowance of 0.9 W/ft² in lobbies. Versions of ASHRAE 90.1 from 1999 through 2013 had a decorative lighting power allowance of 1.0 W/sf. In 1999 the main light source appropriate for decorative and accent lighting was incandescent. Since the 2016 version of the ASHRAE 90.1, the additional decorative lighting allowance has been remained at 0.75 W/ft² which if 1 W/ft is representative of standard incandescent lighting, this lower value would be representative of the change in efficacy to halogen lighting. With the transformation of the lighting market to LED, including products with efficacies that are four times that of halogen lighting, the decorative allowance could be justifiably adjusted to one third of its previous value (i.e. drop from 0.75 W/ft² to 0.25 W/ft²).

To support this proposal Bernie Bauer of Integrated Lighting Concepts, lighting designer and former chair of the IES Mercantile lighting committee, reviewed reasonable adjustments to the decorative lighting allowance and the additional lighting power allowance for retail lighting displays. The results of his work are attached in a separate document. For decorative lighting power he conducted a “top down” evaluation by considering the efficacy of incandescent, halogen and LED light sources and evaluated the relative efficacy of these sources. Additionally, for decorative lighting, he conducted “bottom up” evaluation of several decorative lighting applications with considerable amounts of decorative lighting power and evaluated the additional lighting power that was required over the general lighting allowance.

The results converged on values that are reflected in the proposal of 0.25 W/ft² to 0.45 W/ft² depending upon the application. These results are also reflected in the recently adopted 2022 version of California’s Energy Code (Title 24, Part 6), which applies to approximately 12% of the commercial built environment in the United States. Note that the areas included in the 0.45 W/ft² additional lighting power allowance are

mostly the same applications in California's Energy which can use the Section 140.6 Tailored Method lighting power allowances.

This analysis also provides examples from lighting designs for a range of retail clients from the more basic designs seen in a big box store with limited display lighting to a high-end jewelry store packed with display cases and in-wall vitrines. These designs informed the adjustment of the additional lighting power allowances. Note, these additional allowances were based on an assumed retail sales general lighting allowance of 0.85 W/ft²; if the base allowance is adjusted, the additional allowances for each retail areas number should be adjusted to match a similar total lighting power allowance proposed here.

The cost reductions and beneficial environmental impacts must be considered in the context of artistry, beauty, and amenity of electric lighting. The limitations on decorative lighting and display lighting budgets are not curtailing task performance or visibility, but they do place an upper limit on the amount of electric lighting used for the artistic effects of highlighting, accenting and accentuating the built environment. The whole building performance approach allows trade-offs between different components for extraordinary designs. However, there is no limit on the amount of lighting energy that can be expended on branding or creating a presence with light. In certain commercial districts around the world, the authorities having jurisdiction have exceeded even the relatively high values that are in the existing version of the IECC. These special jurisdiction and applications will likely continue to exist, but this standard sets a standard of care for the sustainability of the built environment appropriate for most jurisdictions.

Bibliography

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Cost Impacts

This proposal will **reduce costs initially and over the life of the lighting system**. Reduced lighting power results in less wattage of luminaires installed and reduced electrical operating cost. Societal cost associated with reduced GHG and other emissions is also saved.

Over the last 9 years, 10 Billion square feet of new commercial buildings have been built. Approximately three times that much of building space is remodeled per year. Combining these areas is approximately 4.5 Billion square feet. The proposed maximum lighting power reduction is around 0.5 W/sf, assuming that half of this reduction applies (not everyone was using the full allowance) and that only 25% of spaces are even using the decorative allowance at all, and that the lighting systems on average operate 2,500 full load hours per year, the electricity savings would be approximately:

$(4,564 \text{ Million square feet}) \times (0.5 \text{ W/ft}^2) \times (0.5 \text{ avg reduction}) \times (0.25 \text{ fraction spaces}) \times (2,500 \text{ h/yr}) =$

1st year new Construction and Alterations Saving = **713 Million kWh/yr.**

The USEPA keeps track of greenhouse gas (GHG) emissions by each eGRID region. The EPA estimates that the average GHG emissions for the United States electricity grid as whole is a CO₂e emission factor of

952.9 lbs/MWH which is equivalent to 432 Metric Tonnes/ Million kWh. Using this nationwide annual emission factor, the GHG reductions associated with this proposal for each year's new construction and alterations is:

GHG Reductions = 713 Million kWh/yr x 432 Metric Tonnes/ Million kWh = **308,000 Metric Tonnes CO₂e**.

2016 Top Performing LED Products*	Luminous Efficacy	Usable Life (L70) [†]
	(lm/W)	(hours)
LED A19 Lamp (Dimmable, 2700 K)	100	25,000
LED PAR38 Lamp (3000 K)	88	25,000
LED T8 Tube (4000 K)	149	50,000
LED 6" Downlight (3000 K)	86	50,000
LED Troffer 2' x 4' (3500 K)	129	50,000
LED High/Low-Bay Fixture (4000 K)	136	60,000
LED Street Light (5000 K)	118	60,000
Conventional Lighting Products	Luminous Efficacy (lm/W)	Usable Life (hours)
Incandescent A19	15	1,000
Halogen A19	20	8,400
CFL A19 Replacement	70	12,000
CFL (Dimmable) A19 Replacement	70	12,000
Linear Fluorescent System [†]	108	25,000
HID (High-Watt) System [†]	115	15,000
HID (Low-Watt) System [†]	104	15,000

CEPI-179-21

IECC®: TABLE C405.3.2(1), TABLE C405.3.2(2)

Proponents: Jeremy Williams, representing U.S. Department of Energy (jeremy.williams@ee.doe.gov)

2021 International Energy Conservation Code

Revise as follows:

TABLE C405.3.2(1) INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

Portions of table not shown remain unchanged.

BUILDING AREA TYPE	LPD (w/ft ²)
Automotive facility	0.75 <u>0.74</u> <u>0.73</u>
Convention center	0.64 <u>0.629</u> <u>0.64</u>
Courthouse	0.79 <u>0.729</u> <u>0.75</u>
Dining: bar lounge/leisure	0.80 <u>0.729</u> <u>0.74</u>
Dining: cafeteria/fast food	0.76 <u>0.679</u> <u>0.70</u>
Dining: family	0.71 <u>0.639</u> <u>0.65</u>
Dormitory ^{a, b}	0.53 <u>0.509</u> <u>0.52</u>
Exercise center	0.72 <u>0.689</u> <u>0.72</u>
Fire station ^a	0.56 <u>0.559</u> <u>0.56</u>
Gymnasium	0.76 <u>0.729</u> <u>0.75</u>
Health care clinic	0.84 <u>0.759</u> <u>0.77</u>
Hospital ^a	0.96 <u>0.919</u> <u>0.92</u>
Hotel/Motel ^{a, b}	0.56 <u>0.519</u> <u>0.53</u>
Library	0.83
Manufacturing facility	0.82
Motion picture theater	0.44 <u>0.419</u> <u>0.43</u>
Multiple-family ^c	<u>0.45</u> <u>0.46</u>
Museum	<u>0.55</u> <u>0.56</u>
Office	0.64 <u>0.609</u> <u>0.62</u>
Parking garage	0.18 <u>0.169</u> <u>0.17</u>
Penitentiary	0.69 <u>0.649</u> <u>0.65</u>
Performing arts theater	0.84 <u>0.809</u> <u>0.82</u>
Police station	0.66 <u>0.609</u> <u>0.62</u>
Post office	0.65 <u>0.629</u> <u>0.64</u>
Religious building	0.67 <u>0.649</u> <u>0.66</u>
Retail	0.84 <u>0.769</u> <u>0.78</u>
School/university	0.72 <u>0.689</u> <u>0.70</u>
Sports arena	0.76 <u>0.699</u> <u>0.73</u>
Town hall	0.69 <u>0.659</u> <u>0.67</u>
Transportation	0.50 <u>0.519</u> <u>0.56</u>
Warehouse	0.45
Workshop	0.94 <u>0.859</u> <u>0.86</u>

TABLE C405.3.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

Portions of table not shown remain unchanged.

COMMON SPACE TYPES ^a	LPD (watts/ft ²)
Atrium	
Less than 40 feet in height	0.48 0.409 0.41
Greater than 40 feet in height	0.60 0.509 0.51
Audience seating area	
In an auditorium	0.64 0.569 0.57
In a gymnasium	0.23
In a motion picture theater	0.27
In a penitentiary	0.67 0.559 0.56
In a performing arts theater	1.16 1.09 1.09
In a religious building	0.72
In a sports arena	0.33 0.269 0.27
Otherwise	0.33
Banking activity area	0.64 0.559 0.56
Breakroom (See Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	0.89 0.739 0.74
Otherwise	0.74 0.719 0.72
Computer room, data center	0.94 0.749 0.75
Conference/meeting/multipurpose room	0.97 0.879 0.88
Copy/print room	0.34 0.559 0.56
Corridor	
In a facility for the visually impaired (and not used primarily by the staff) ^b	0.71
In a hospital	0.74 0.609 0.61
Otherwise	0.44 0.439 0.44
Courtroom	1.20 1.079 1.08
Dining area	
In bar/lounge or leisure dining	0.86 0.759 0.76
In cafeteria or fast food dining	0.40 0.359 0.36
In a facility for the visually impaired (and not used primarily by the staff) ^b	1.27 1.219 1.22
In family dining	0.60 0.519 0.52
In a penitentiary	0.42 0.349 0.35
Otherwise	0.43 0.419 0.42
Electrical/mechanical room	0.43 0.709 0.71
Emergency vehicle garage	0.52 0.509 0.51
Food preparation area	1.09 1.189 1.19
Guestroom ^{c, d}	0.41
Laboratory	
In or as a classroom	1.14 1.049 1.05
Otherwise	1.33 1.209 1.21
Laundry/washing area	0.53 0.509 0.51
Loading dock, interior	0.88
Lobby	
For an elevator	0.65 0.639 0.64

COMMON SPACE TYPES	LPD (watts/ft ²)
In a facility for the visually impaired (and not used primarily by the staff) ^b	1.69 1.439 1.44
In a hotel	0.54 0.48
In a motion picture theater	0.23 0.199 0.20
In a performing arts theater	1.25 1.209 1.21
Otherwise	0.84 0.769 0.80
Locker room	0.52 0.43
Lounge/breakroom	
In a healthcare facility	0.42 0.769 0.77
Mother's Wellness Room	0.68
Otherwise	0.59 0.549 0.55
Office	
Enclosed	0.74 0.729 0.73
Open plan	0.64 0.559 0.56
Parking area daylight transition zone	1.059 1.06
Parking area, interior	0.15 0.109 0.11
Pharmacy area	1.66 1.609 1.59
Restroom	
In a facility for the visually impaired (and not used primarily by the staff) ^b	1.26 0.959 0.96
Otherwise	0.63 0.559 0.74
Sales area	1.05 0.849 0.85
Seating area, general	0.23 0.209 0.21
Security Screening General Areas	0.639 0.64
Security Screening in Transportation Facilities	0.929 0.93
Security Screening Transportation Waiting Area	0.559 0.56
Stairwell	0.49 0.469 0.47
Storage room	0.38 0.349 0.35
Vehicular maintenance area	0.60 0.589 0.59
Workshop	1.26 1.169 1.17
BUILDING TYPE SPECIFIC SPACE TYPES ^a	LPD (watts/ft ²)
Automotive (see Vehicular maintenance area)	
Convention Center—exhibit space	0.64 0.499 0.50
Dormitory—living quarters ^{c, d}	0.50 0.479 0.48
Facility for the visually impaired ^b	
In a chapel (and not used primarily by the staff)	0.70 0.579 0.58
In a recreation room (and not used primarily by the staff)	1.77 1.318 1.20
Fire Station—sleeping quarters ^c	0.23
Gaming Establishments	
High Limits Game	1.678 1.68
Slots	0.539 0.54
Sportsbook	0.819 0.82
Table Games	1.089 1.09
Gymnasium/fitness center	
In an exercise area	0.90 0.819 0.82
In a playing area	0.85 0.619 0.82
Healthcare facility	
In an exam/treatment room	1.40 1.328 1.33

COMMON SPACE TYPES	LPD (watts/ft ²)
In an imaging room	0.94
In a medical supply room	0.62 0.669 0.56
In a nursery	0.92 0.869 0.87
In a nurse's station	1.17 1.069 1.07
In an operating room	2.26 2.309 2.26
In a patient room ^c	0.68
In a physical therapy room	0.94 0.819 0.87
In a recovery room	1.25 1.179 1.18
In a telemedicine room	1.439 1.44
Library	
In a reading area	0.96 0.859 0.86
In the stacks	1.18
Manufacturing facility	
In a detailed manufacturing area	0.80 0.749 0.75
In an equipment room	0.76 0.729 0.73
In an extra-high-bay area (greater than 50 feet floor-to-ceiling height)	1.42
In a low-bay area (less than 25 feet floor-to-ceiling height)	0.86
In a high-bay area (25–50 feet floor-to-ceiling height)	1.24
In a low-bay area (less than 25 feet floor-to-ceiling height)	0.86
In an extra-high-bay area (greater than 50 feet floor-to-ceiling height)	1.42 <u>1.36</u>
Museum	
In a general exhibition area	0.31
In a restoration room	1.10 1.239 1.24
Performing arts theater—dressing room	0.41 0.389 0.39
Post office—sorting area	0.76 0.709 0.71
Religious buildings	
In a fellowship hall	0.54 0.499 0.50
In a worship/pulpit/choir area	0.85 0.749 0.75
Retail facilities	
In a dressing/fitting room	0.51 0.449 0.45
Hair salon	0.649 0.65
Nail salon	0.749 0.75
In a mall concourse	0.82 0.569 0.57
Massage space	0.809 0.81
Sports arena—playing area	
For a Class I facility ^a	2.94 2.869 2.86
For a Class II facility ^f	2.04 1.879 1.88
For a Class III facility ^g	1.30 1.289 1.29
For a Class IV facility ^h	0.86
Sports arena—Pools	
For a Class I facility	2.199 2.20
For a Class II facility	1.469 1.47
For a Class III facility	0.989 0.99
For a Class IV facility	0.689 0.69
Transportation facility	
Airport Hanger	1.359 1.36

COMMON SPACE TYPES	LPD (watts/ft ²)
At a terminal ticket counter	0.54 0.399 0.40
In a baggage/carousel area	0.39 0.279 0.28
Passenger Loading Area	0.71
In an airport concourse	0.25 0.489 0.49
Warehouse—storage area	
For medium to bulky, palletized items	0.33
For smaller, hand-carried items	0.69

Reason: The values in Table C405.3.2(2) are interlinked with the values in Table C405.3.2(1). The building values [Table C405.3.2(1)] are comprised via aggregating the individual space values [Table C405.3.2(1)].

These proposed values were developed via a multi-step analysis:

- More than 150 data sheets from more than 10 lighting manufacturers data sheets were compiled.
- The 2021 data sheets indicate increased efficacy compared to products from 2018 and 2019. At least 2/3 of the data sheets compared were the same fixture from 2019 and 2021. For most of the directly tracked products, the efficacy of these fixtures had increased in this time.
- Lighting conditions were modeled for each of the spaces using these 2021 efficacy values and the resultant lighting power density values were these proposed values.

These proposed values represent a 4 - 5% reduction (based on a straight average of changes) compared to the previous version. These proposed values are similar to those that are being considered by ANSI/ASHRAE/IES Standard 90.1.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.

There is no cost increase for this proposal. The proposed reduced lighting power density values are based on manufacturer data sheets.

Manufacturers have improved the performance of their products and these values are based on their improvements. As stated in the rationale, more than 150 products were evaluated. Between 2018 and 2021, these fixtures became more efficient. Cost changes between 2018 and 2021 are not from changes in efficacy, but inflation, supply chain, and material constraints.

CEPI-184 Mod:
IECC Proposal Additional Lighting Power

C405.3.2.2.1 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 controlled in accordance with Section C405.2.5. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. ~~This additional power shall be permitted only in the space for which it is claimed and may not be added to the interior power allowance for other spaces.~~ 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 4-11.

<p>Additional interior lighting power allowance = 1000 W + (Retail Area 1 × 0.45 W/ft²) + (Retail Area 2 × 0.45W/ft²) + (Retail Area 3 × 1.05 W/ft²) + (Retail Area 4 × 1.87 W/ft²) For SI units: Additional interior lighting power allowance = 1000 W + (Retail Area 1 × 4.8 W/m²) + (Retail Area 2 × 4.84 W/m²) + (Retail Area 3 × 11 W/m²) + (Retail Area 4 × 20 W/m²)</p>	(Equation 4-11)
<p><u>Additional Lighting Power Allowance = 500 W + (Retail Area 1 x 0.40 W/ft²) + (Retail Area 2 x 0.40 W/ft²) + (Retail Area 3 x 1.0 W/ft²) + (Retail Area 4 x 1.2 W/ft²)</u> <u>For SI Units Additional Lighting Power Allowance = 500 W + (Retail Area 1 x 4.3 W/m²) + (Retail Area 2 x 4.3 W/m²) + (Retail Area 3 x 11 W/m²) + (Retail Area 4 x 13 W/m²)</u></p>	(Equation 4-11)

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.
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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.

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3. In facilities for the visually impaired, spaces with transition lighting that is turned OFF at night by astronomical time clock, the wattage of the controlled lighting power up to 0.90 W/ft² of additional power is allowed for areas within 30 feet of an exit that is not in a skylight daylit zone or a sidelit daylit zone

- This proposal provides sufficient decorative and retail lighting additional lighting power to develop beautiful lighting designs that enhance the built environment while limiting energy waste and helping preserve resources and the global environment
- This proposal will reduce costs initially and over the life of the lighting system.
- Reduced lighting power results in less wattage of luminaires installed and reduced electrical operating cost. Payback is instantaneous.
- This proposal will reduce the amount of environmental pollution associated with operating electric lighting.

The IECC decorative allowance of 0.75 W/ft² is the same as the decorative allowance in ASHRAE 90.1-2019, except for one space type; the IECC allows a decorative allowance of 0.9 W/ft² in lobbies. Versions of ASHRAE 90.1 from 1999 through 2013 had a decorative lighting power allowance of 1.0 W/sf. In 1999 the main light source appropriate for decorative and accent lighting was incandescent. Since the 2016 version of the ASHRAE 90.1, the additional decorative lighting allowance has been remained at 0.75 W/ft² which if 1 W/ft is representative of standard incandescent lighting, this lower value would be representative of the change in efficacy to halogen lighting. With the transformation of the lighting market to LED, including products with efficacies that are four times that of halogen lighting, the decorative allowance could be justifiably adjusted to one third of its previous value (i.e. drop from 0.75 W/ft² to 0.25 W/ft²).

To support this proposal Bernie Bauer of Integrated Lighting Concepts, lighting designer and former chair of the IES Mercantile lighting committee, reviewed reasonable adjustments to the decorative lighting allowance and the additional lighting power allowance for retail lighting displays. The results of his work are attached in a separate document. For decorative lighting power he conducted a “top down” evaluation by considering the efficacy of incandescent, halogen and LED light sources and evaluated the relative efficacy of these sources. Additionally, for decorative lighting, he conducted “bottom up” evaluation of several decorative lighting applications with considerable amounts of decorative lighting power and evaluated the additional lighting power that was required over the general lighting allowance.

The results converged on values that are reflected in the proposal of 0.25 W/ft² to 0.45 W/ft² depending upon the application. These results are also reflected in the recently adopted 2022 version of California’s Energy Code (Title 24, Part 6), which applies to approximately 12% of the commercial built environment in the United States. Note that the areas included in the 0.45 W/ft² additional lighting power allowance are mostly the same applications in California’s Energy which can use the Section 140.6 Tailored Method lighting power allowances. This analysis also provides examples from lighting designs for a range of retail clients from the more basic designs seen in a big box store with limited display lighting to a high-end jewelry store packed with display cases and in-wall vitrines. These designs informed the adjustment of the additional lighting power allowances. Note, these additional allowances were based on an assumed retail sales general lighting allowance of 0.85 W/ft²; if the base allowance is adjusted, the additional allowances for each retail areas number should be adjusted to match a similar total lighting power allowance proposed here.

The cost reductions and beneficial environmental impacts must be considered in the context of artistry, beauty, and amenity of electric lighting. The limitations on decorative lighting and display lighting budgets are not curtailing task performance or visibility, but they do place an upper limit on the amount of electric lighting used for the artistic effects of highlighting, accenting and accentuating the built environment. The whole building performance approach allows trade-offs between different components for extraordinary designs. However, there is no limit on the amount of lighting energy that can be expended on branding or creating a presence with light. In certain commercial districts around the world, the authorities having jurisdiction have exceeded even the relatively high values that are in the existing version of the IECC. These special jurisdiction and applications will likely continue to exist, but this standard sets a standard of care for the sustainability of the built environment appropriate for most jurisdictions.

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Cost Impacts

This proposal will **reduce costs initially and over the life of the lighting system**. Reduced lighting power results in less wattage of luminaires installed and reduced electrical operating cost. Societal cost associated with reduced GHG and other emissions is also saved.

Over the last 9 years, 10 Billion square feet of new commercial buildings have been built. Approximately three times that much of building space is remodeled per year. Combining these areas is approximately 4.5 Billion square feet. The proposed maximum lighting power reduction is around 0.5 W/sf, assuming that half of this reduction applies (not everyone was using the full allowance) and that only 25% of spaces are even using the decorative allowance at all, and that the lighting systems on average operate 2,500 full load hours per year, the electricity savings would be approximately:

$$(4,564 \text{ Million square feet}) \times (0.5 \text{ W/ft}^2) \times (0.5 \text{ avg reduction}) \times (0.25 \text{ fraction spaces}) \times (2,500 \text{ h/yr}) = 1^{\text{st}} \text{ year new Construction and Alterations Saving} = \mathbf{713 \text{ Million kWh/yr}}$$

The USEPA keeps track of greenhouse gas (GHG) emissions by each eGRID region. The EPA estimates that the average GHG emissions for the United States electricity grid as whole is a CO₂e emission factor of 952.9 lbs/MWH which is equivalent to 432 Metric Tonnes/ Million kWh. Using this nationwide annual emission factor, the GHG reductions associated with this proposal for each year’s new construction and alterations is:

$$\mathbf{GHG \text{ Reductions} = 713 \text{ Million kWh/yr} \times 432 \text{ Metric Tonnes/ Million kWh} = \mathbf{308,000 \text{ Metric Tonnes CO}_2\text{e}}$$

2016 Top Performing LED Products*	Luminous Efficacy	Usable Life (L70) [†]
	(lm/W)	(hours)
LED A19 Lamp (Dimmable, 2700 K)	100	25,000
LED PAR38 Lamp (3000 K)	88	25,000
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CEPI-184 Mod:

IECC Proposal Additional Lighting Power

C405.3.2.2.1 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 controlled in accordance with Section C405.2.5. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. ~~This additional power shall be permitted only in the space for which it is claimed and may not be added to the interior power allowance for other spaces.~~ 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 4-11.

<p>Additional interior lighting power allowance = $1000 \text{ W} + (\text{Retail Area 1} \times 0.45 \text{ W/ft}^2) +$ $(\text{Retail Area 2} \times 0.45 \text{ W/ft}^2) + (\text{Retail Area 3} \times$ $1.05 \text{ W/ft}^2) + (\text{Retail Area 4} \times 1.87 \text{ W/ft}^2)$ For SI units: Additional interior lighting power allowance = $1000 \text{ W} + (\text{Retail Area 1} \times 4.8 \text{ W/m}^2) +$ $(\text{Retail Area 2} \times 4.84 \text{ W/m}^2) + (\text{Retail Area 3}$ $\times 11 \text{ W/m}^2) + (\text{Retail Area 4} \times 20 \text{ W/m}^2)$</p>	<p>(Equation 4-11)</p>
<p><u>Additional Lighting Power Allowance =</u> $500 \text{ W} + (\text{Retail Area 1} \times 0.40 \text{ W/ft}^2) +$ $(\text{Retail Area 2} \times 0.40 \text{ W/ft}^2) + (\text{Retail Area 3} \times 1.0 \text{ W/ft}^2) +$ $(\text{Retail Area 4} \times 1.2 \text{ W/ft}^2)$ <u>For SI Units</u> <u>Additional Lighting Power Allowance =</u> $500 \text{ W} + (\text{Retail Area 1} \times 4.3 \text{ W/m}^2) +$ $(\text{Retail Area 2} \times 4.3 \text{ W/m}^2) + (\text{Retail Area 3} \times 11 \text{ W/m}^2) +$ $(\text{Retail Area 4} \times 13 \text{ W/m}^2)$</p>	<p>(Equation 4-11)</p>

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 ~~0.9~~ 0.45 W/ft² (~~9.7~~ 4.8 W/m²) in ballrooms, beauty & spa, casinos, facilities for the visually impaired, leisure dining, lobbies, performing arts, retail sales, religious worship and not more than ~~0.75~~ 0.25 W/ft² (~~8.1~~ 2.7 W/m²) in other spaces. This additional power shall be permitted only in the space for which it is claimed and may not be added to the interior power allowance for other spaces.

3. In facilities for the visually impaired, spaces with transition lighting that is turned OFF at night by astronomical time clock, the wattage of the controlled lighting power up to 0.90 W/ft² of additional power is allowed for areas within 30 feet of an exit that is not in a skylight daylit zone or a sidelit daylit zone

Reason

- This proposal provides sufficient decorative and retail lighting additional lighting power to develop beautiful lighting designs that enhance the built environment while limiting energy waste and helping preserve resources and the global environment
- This proposal will reduce costs initially and over the life of the lighting system.
- Reduced lighting power results in less wattage of luminaires installed and reduced electrical operating cost. Payback is instantaneous.
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