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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

REVISED DEFINITION OF RETAIL MERCHANDISE SALES PERIMETER WALL LENGTH AND GROCERY STORE LIGHTING POWER

July 24, 2026

California Energy Commission

Docket No. 25-BSTD-03

The California Statewide Codes and Standards Enhancement (CASE) initiative presents recommendations to support the California Energy Commission's (CEC's) efforts to update California's Energy Code (Title 24, Part 6), including revisions to simplify and clarify existing code requirements. Three California Investor-Owned Utilities (IOUs) — Pacific Gas & Electric Company, San Diego Gas & Electric, and Southern California Edison sponsored this effort as a group.

With the objective of improving compliance, this letter recommends adjustments to the *Indoor Lighting Power Density Final CASE Report*[1] to simplify requirements for retail merchandise sales and retail grocery sales areas.

This letter supports two additional changes to those recommended in the LPD CASE report. These changes were developed in collaboration with a retail lighting subject matter expert and shares research and analysis and the resulting recommendations. Changes suggested in this letter modify and clarify the wording on what wall configurations are included in the length of retail merchandise sales area walls and a simplification of the LPD allowances for retail grocery sales. The suggested minor adjustments do not require the use of the full codes and standards enhancement report template.

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[1] https://efiling.energy.ca.gov/GetDocument.aspx?tn=270766&DocumentContentId=108316

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1. Measure Description and Justification

1.1 Proposal Description

This proposal builds upon the content in the *Indoor Lighting Power Density Final CASE Report* and contains two recommendations:

- Expand the definition of perimeter walls for the wall decorative/display allowance used in retail merchandise sales to include the length of *"*perimeter illuminated *ceiling bulkhead walls* formed by a vertical offset in ceiling heights of three feet and greater*,"* where *ceiling bulkhead walls* are defined as "interior vertical walls or vertical partitions that span the transition in height between adjacent ceilings of different heights."
- Simplify the calculated indoor allowed lighting power for retail grocery sales and update the proposed values based on detailed models of specialty grocery stores.

1.2 Benefits of Proposed Change

Adjusting the definition of perimeter walls to include perimeter bulkhead walls for ceiling offsets greater than three feet increases the wall decorative/display allowance for a limited number of sales floor retrofits where the altered space is within a larger space. The applicability is small but meaningful. Lighting designers working on specialty retail projects receive more flexibility for the wall display allowance component of alteration projects, without unnecessarily impacting other specialty retail power allowances.

Simplifying Grocery Sales so that it contains allowances based only on the floor area of the space is intended to be easier to enforce than layering on top additional allowances that are based on the length of perimeter walls. This is aligned with all other spaces in the proposed 2028 areas category method except for retail merchandise sales. Currently, the Grocery Sales primary function area has allowances for three different ceiling heights and has a decorative/display allowance that is a function of floor area and a decorative/display allowance that is a function of wall length. This set of allowances can be simplified to a single lighting power allowance for all ceiling heights consisting of a general lighting power allowance and an additional power allowance decorative/display lighting. This revised format for grocery sales is comparable to most of the other primary function areas using the Area Category Method for prescriptive lighting compliance.

1.3 Background Information – Retail Sales Alterations

Appendix H of the *Indoor Lighting Power Density Final CASE Report* contains an example of a high-end shoe store (see Figure 1). The core zone of the store has a 14 to 15 feet ceiling and wrapped around three quarters of the core zone is surrounded by a perimeter subspace with a 10-foot ceiling. The entire shoe store complies with the proposed new lighting power allowances that account for general lighting, display/decorative lighting, and wall display/decorative lighting. But if the core zone is remodeled without including the perimeter zones, this core zone (with significant decorative/display lighting) would not comply unless the perimeter bulkhead of this space is treated as part of the perimeter wall length. Compliance for a partial alteration of the core of the store is difficult because the bulkhead walls currently do not qualify for the wall decorative/display allowance, but these bulkhead walls are illuminated along their entire length so that the core sales space does not have a dark upper cavity along the perimeter. If one wanted this design to comply without including the bulkhead walls in the wall decorative/display allowance, one could increase the other allowances, but this would not be a good outcome as increasing the other allowances is not required to pass retrofits for the other retail merchandising prototype models.

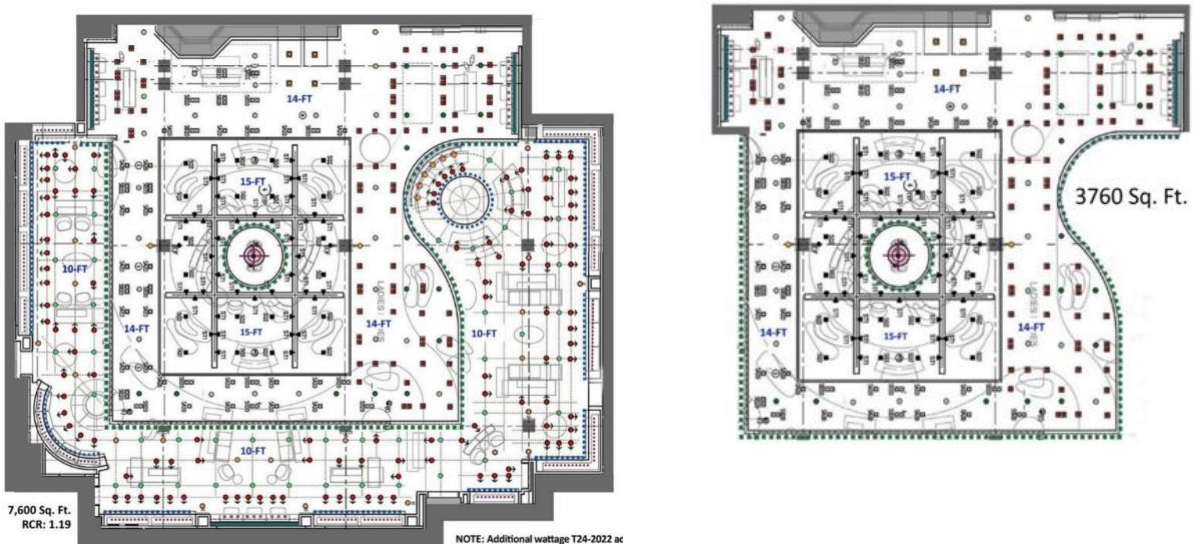


Figure 1: High-End Shoe Store And Example Of Problematic Partial Retrofit With Few Full Height Walls And Significant Areas Of Bulkhead Lighting

A CABEC Certified Compliance Analyst indicated that some of their retail projects include partial retrofits of an enclosed space where a department is upgraded, but the rest of the retail merchandise space is untouched. With the relatively high allowances in the 2025 Energy Code (Title 24, Part 6), these partial retrofits could easily comply without having to use the display wall allowance. In several of these cases, the jurisdiction was agreeable to having a permitted portion of the store being upgraded to a

much lower LPD without requiring the rest of the main selling floor from being upgraded. Adjusting the definition for perimeter wall assemblies to allow qualifying bulkheads when determining the perimeter wall length would be superior to an outcome that reduced the stringency of retail lighting allowances for all applications.

1.4 Background Information – Grocery Store LPDs

For the 2025 code cycle, LPDs were not updated except for moving some of the values from the Tailored Lighting Method into the Area Category Method. The reasoning for these changes can be found in the 2025 docketed presentation, *2025 Title 24 Lighting Language Cleanup Initiative.*[2] This proposal was well-researched and used a robust energy code compliance database to understand the relative use of tailored lighting method, finding that that of the 11 space types in the Tailored Lighting Method only three space types were used more than 1% of the time. These three space types with high use of tailored lighting were: Exhibit Museum Area (21%), Retail Merchandise Sales (19%), and Dining Area (6%). Out of the 280 grocery stores in the compliance database, only two (0.7%) used the Tailored Lighting Method. At that time, the 2022 Energy Code was in effect and the area category allowances for grocery store lighting was 1.00 W/ft^2 for general lighting and 0.35 W/ft^2 for decorative/display lighting. However, those few grocery stores complying with the 2022 standard could choose to use tailored lighting method and have much larger allowances with 0.35 W/ft^2 for decorative lighting, an additional 0.60 W/ft^2 for floor display and task, and 6.6 W/linear foot of wall display.

Lighting power densities are developed from what are demanding lighting design scenarios but with the use of efficient light sources. The proposed update to grocery store LPDs in this letter is based on two specialty grocery store model described below. These models are developed from publicly available sets of plans for two specialty grocery stores. To be conservative and represent a more energy intensive design than what was on the plan set, the models were enhanced with additional layers of decorative and display lighting. After evaluating, it was apparent that the wall decorative/display allowance was not essential to the lighting layout. The grocery spaces are relatively large, so the ratio of perimeter wall length to square footage of the space is small. Additionally, the density of high illuminance display lighting is relatively low when compared to high end product retail.

[2] https://efiling.energy.ca.gov/GetDocument.aspx?tn=250676&DocumentContentId=85462

The allowed grocery store lighting power in the Space-by-Space Method in ASHRAE 90.1-2025 is the combination of the following for a maximum of 1.69 W/ft^2:

- 0.79 W/ft^2 maximum base space LPD for sales area space type,
- 0.50 W/ft^2 decorative lighting additional lighting power, and
- 0.40 W/ft^2 display lighting additional lighting power for Retail Area 1 (all other).

A database of 2022 California Energy Code prescriptive compliance building data including total building LPD was evaluated by building type. This includes the lighting data from all prescriptive compliance paths (Complete Building Method, Area Category Method and Tailored Method). Figure 2 contains a summary of the fraction of grocery store area with respect to whole building LPD.

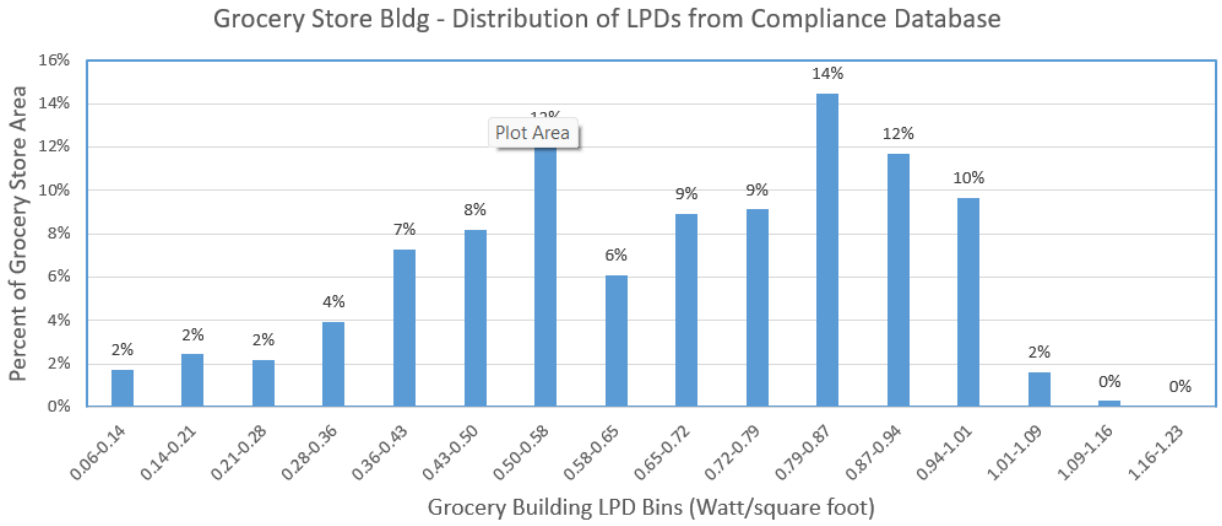


Figure 2: Distribution of Grocery Store Total Lighting Power Densities (W/ft^2)

Notable results from this evaluation are as follows:

- Highest[3] grocery building LPD in the database is 1.18 W/ft^2
- Median LPD is 0.60 W/ft^2
- Average LPD is 0.65 W/ft^2
- 97th percentile is 1.0 W/ft^2 and less.

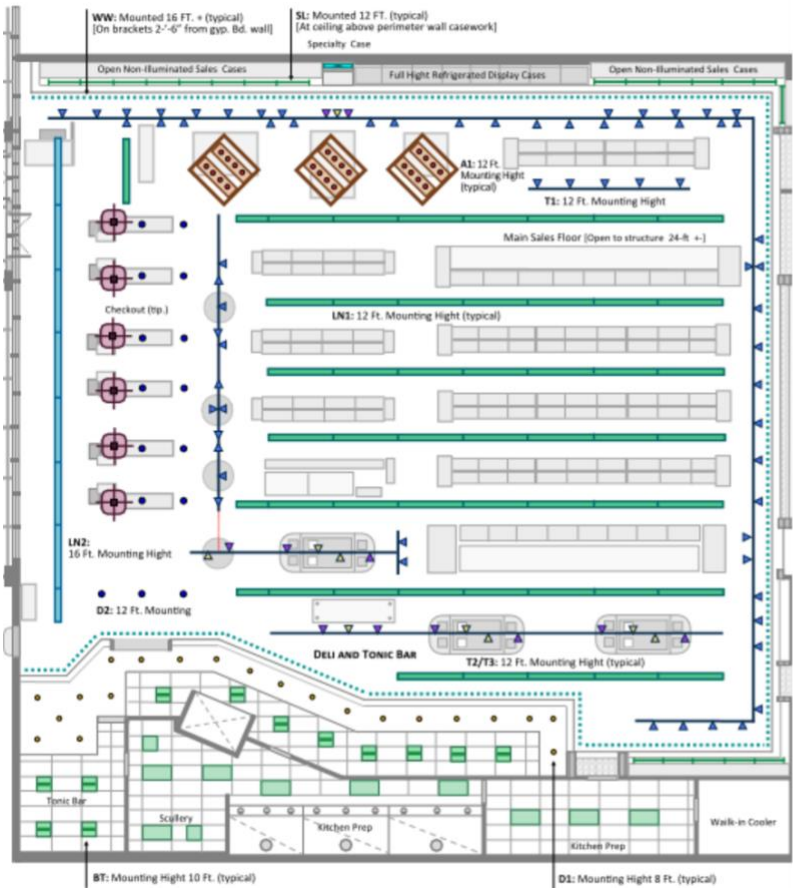
[3] Note that highest histogram bin is 1.16 to 1.23 W/ft^2 in Figure 2 but highest value in that bin is 1.18 W/ft^2.

- Grocery sales floor LPD is higher as other spaces (warehouse, loading dock, office, etc.) in grocery stores have lower lighting power needs.

For the specialty grocery stores accessed via the database of publicly available plan sets, the sales floor was between 50% and 67% of total building floor area.

1.5 Specialty Grocery Store Models

Lighting power densities are developed from what are demanding grocery lighting scenarios with substantial use of decorative/display lighting and illuminating the ceiling cavity and upper portion of walls but with the use of efficient light sources. The standard grocery store can relatively easily meet the lighting power density requirements as these stores have larger, more efficient light sources providing a relatively uniform illuminance in the space.



LIGHTING LEGEND—LUMINAIRE SPECIFICATIONS

14W	D1	4-inch downlight [Wide flood 3000K/95 CRI]
24W	D2	6-inch pendant [Narrow flood 3000K/80 CRI]
19W	A1	4-inch accent light [Wide spot 3000K/80 CRI]
29W	T1	Track head [Narrow flood 3000K/80 CRI]
29W	T2	Track head [Narrow flood 3000K/95 CRI]
29W	T3	Track accent head [Spot 3000K/95 CRI]
16W	WG	4-foot Wall-grazer [Grazing optic 3000K/80 CRI]
7.5W (ln. ft.)	SL	LED linear channel [3500K/80 CRI]
4.75W (ln. ft.)	WW	Linear wall-washer [3500K/80 CRI]
11.5W (ln. ft.)	LN1	Linear up/down asle light [3500K/80 CRI]
15.5W (ln. ft.)	LN2	Linear up/down asle light [3500K/80 CRI]
26W	BT	2X2 basket troffer [3000K/90 CRI]
39W	LP	2X4 LED panel troffer [3500K/80 CRI]
115W	DC	Decorative chandelier with built-in downlight [3000K 90 CRI glow illumination plus NFL downlight]

FIXTURE	WATTS	QUANTITY	TOTAL W	ASSIGNED
D1	14	21	294	Accent/ Display
D2	24	15	360	General
A1	19	24	456	Accent/ Display
T1	29	68	1972	Accent/ Display
T2	29	9	261	Accent/ Display
T3	29	10	290	Accent/ Display
WG	16	1	16	Decorative
SL	7.5	82	615	Accent/ Display
WW	4.45	308	1371	Decorative
LN1	11.5	396	4554	General
LN2	15.5	60	930	General
BT	26	12	312	General
DC	115	6	690	Decorative
SALES FLOOR (9450 SQ. FT.) TOTAL LIGHTING POWER			12,121	1.28 W Sq. Ft. LPD

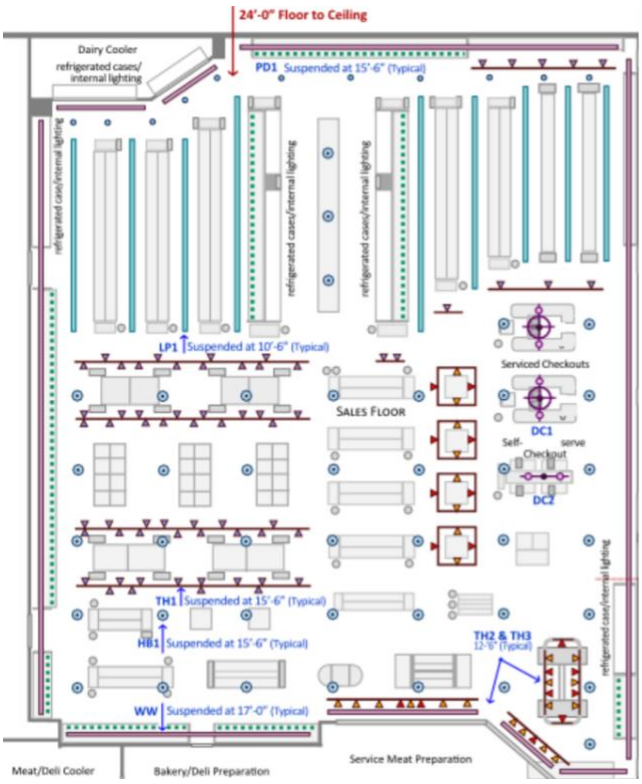
Figure 3: Specialty Grocery Store Layout (Model 1) Luminaire Schedule and Wattage Calculation

Specialty grocery stores are characterized by smaller floor areas, higher ceilings and more decorative/display lighting with smaller and less efficient light sources, as well as

non-uniform light levels. The update to the grocery store prototypical model was achieved by accessing publicly available sets of plans for two different types of specialty grocery stores and augmented with additional layers of decorative and display lighting including adding more uplight to the ceiling and wall washing high perimeter walls.

Figure 3 illustrates the first of these models with a significant amount of ornamental and display lighting. Illumination targets are:

- Base lighting 50-60 fc,
- Highlighting 70-80 fc,
- Accent lighting 150-350 fc and
- Vertical wall illumination of 40-50 fc.



SALES FLOOR LUMINAIRE SCHEDULE & LIGHTING SPECIFICATIONS

PD1	Pendant downlight 97W 8,930 lumens [3500K/90 CRI]
HB1	High Bay fixture 125W 15,350 lumens [3500K/90 CRI]
LP1	Linear pendant fixture 11.5W Lin. Foot / 1,004 lumens per foot [3500K/90 CRI]
LDS	Valance/soffit fixture 10.25W Lin. Foot / 1,126 lumens per foot [3500K/90 CRI]
WW	Linear wall-washer 9.4W Lin. Foot / 1,064 lumens per foot [3500K/80 CRI]
TH1	Track head accent light 45W 3,425 lumens Narrow Flood [3000K/90 CRI]
TH2 TH3	Track head accent light (TH2) 30W 2,050 lumens Spot [3000K/95+ CRI] Track head accent light (TH2) 28W 1,950 lumens Narrow Flood [3000K/95+ CRI]
DC1	Decorative vertical cylinder circular fame chandelier with downlight (132W Total) [Two 48W 3500K/80CRI 4000 lumen translucent cylinders with Two 16W 3000K/90 CRI 1320 lumen narrow flood downlights]
DC2	Decorative vertical cylinder linear frame chandelier with downlight (132W Total) [Two 48W 3500K/80CRI 4000 lumen translucent cylinders with Two 16W 3000K/90 CRI 1320 lumen narrow flood downlights]

Sales Floor 14,350 Sq. Ft. Lighting Power Density

FIXTURE	WATTS	QUANTITY	TOTAL WATTS	ASSIGNED
PD	97	11	1067	General
HB1	125	41	5125	General
LP1	10.5	328	3444	General
WW	9.4	440	4136	Decorative
TH1	45	65	2925	Accent/Display
TH2	30	17	510	Accent/Display
TH3	28	24	672	Accent/Display
LDS	10.25	248	2542	Accent/Display
DC1	128	2	256	Decorative
DC2	128	1	128	Decorative
SALES FLOOR LPD:			20,805	1.45 W Sq. Ft.

Figure 4: Specialty Grocery Store Layout (Model 2) Luminaire Schedule and Wattage Calculation

The primary form of general illumination in Model 1 is provided by linear pendants mounted at 12 feet which have an indirect/direct luminance distribution pattern that brighten the 24 foot high ceiling while placing lighting down on the sales floor. Downlights provide task lighting by checkout and by deli areas, as well as some circulation lighting. Decorative chandeliers over check-out provide aesthetic interest and

useful task lighting. Lighting track supports flood and spotlights for highlighting merchandise and brightening wall surfaces that may contain signage or other graphics. The three gondolas in the upper right portion of the plan have custom suspended casework containing 24 accent lights that are 19 watts each. The perimeter, except the exit side of the store near check out, has linear wall washers that brighten the upper wall surfaces of this space. The overall lighting power density of this space with many design features requires 1.28 W/ft^2.

The second model illustrated in Figure 4, has similar illumination targets as Model 1 except for a higher vertical wall illumination target of 60-80 fc. General lighting is provided by linear pendants, high bay fixtures and high-intensity downlights. Checkout lighting is served by decorative cylinder fixtures containing flood lights which place higher levels of light at the financial transaction area. Accent/display lighting is provided by spot and flood lights mounted on track as well as by valence lighting in some of the display cases.

Table 1: Grocery Sales Floor Models – Wattage and LPD by Lighting System Type

Category	Model 1 Watts	Model 1 Watts/ft^2	Model 2 Watts	Model 2 Watts/ft^2
General	6,156	0.65	9,636	0.67
Accent/display	3,888	0.41	6,649	0.46
Decorative	2,077	0.22	4,520	0.31
Decorative/display	5,965	0.63	11,169	0.78
Total	**12,121**	**1.28**	**20,805**	**1.45**

As summarized by the descriptions above and in Table 1, these designs demonstrate that highly featured designs can comply with the lighting power densities that are less than 1.5 W/ft^2. The rows with blue text in the table indicate the general and the combined decorative/display wattages and LPDs in the two models. This informs a proposal to remove the wall decorative/display layer and have a more straight-forward lighting power allowance based on a baseline lighting power allowance supplemented by an additional lighting power allowance for decorative/display lighting.

Similar to the decisions made during the development of the lighting allowances in the 2022 energy code, decorative and display/accent lighting are combined into one qualifying lighting system, “decorative/display.” Many of the same light sources can be used for either decorative or display lighting, sometimes at the same time. Additionally, a single combined value provides the lighting designer with more flexibility to allocate lighting power to the lighting system types appropriate for the design. In keeping with the current area category method ruleset, installed decorative/display lighting power above a given room’s decorative/display allowance can be allocated the overall project’s

baseline general lighting allowance, but when the installed decorative/display power in a given room is less than the decorative/display allowance, the left over decorative/display allowance cannot be used elsewhere.

Consideration was given to having different allowances for ceiling heights greater or less than 15 feet, but the total LPD difference was only 6%. A single higher value was simpler for compliance. Similar to the findings in *the Indoor Lighting Power Density Final CASE Report* for the 2028 standards, lighting efficacy has increased by 15% since 2022 and correspondingly the baseline LPD is proposed to be dropped from 1.0 W/ft^2 as published in the Area Category table in the 2022 and 2025 standards down to 0.85 W/ft^2 and the decorative/display lighting allowance is proposed to be set to 0.65 W/ft^2 as compared to the prior 0.35 W/ft^2 decorative allowance and the 2025 Title 24 floor display allowance that varied between 0.60 and 0.80 W/ft^2 depending upon luminaire mounting height. Additional allowances for tall ceilings, and wall display allowances would also be eliminated.

As proposed, compliance would be simplified and the baseline LPD reduced to match changes in lighting efficacy while providing use-it-or-lose-it additional power allowances designed to accommodate multi-layered decorative/display lighting using efficient light sources. The proposed maximum lighting power allowance of 1.50 W/ft^2 for the 2028 Title 24, part 6 standard is 11% lower than maximum 1.69 W/ft^2 space by space lighting power allowance for ASHRAE 90.1-2025.

2. Stakeholder Engagement to Inform Proposal

While the Statewide CASE Team interviewed several designers and manufacturers and held two stakeholder meetings to solicit comments on the Indoor Lighting Power Density (LPD) CASE report, the contents of this report have not been directly addressed with all of the stakeholders who participated in the process to date. By submitting this comment letter to the docket, this provides an opportunity to highlight proposed updates to the grocery store LPDs and revise the definition of the perimeter wall length for wall decorative/display allowances with the express purpose of soliciting stakeholder comments on these concepts.

3. Proposed Code Language

The proposed changes to the standards, Reference Appendices, and the Alternative Calculation Method (ACM) Reference Manuals are provided below. Changes to the 2025 compliance documents as described in the Indoor Lighting Power Density CASE report are marked with dark blue underlining (new language) and ~~strikethroughs~~ (deletions). The added changes recommended by this comment letter are highlighted in

yellow and marked with dark blue double underlining (new language) and ~~double strikethroughs~~ (deletions).

3.1 Energy Code (Title 24, Part 6)

SECTION 201 *[100.1]* DEFINITIONS

…

CEILING BULKHEAD WALLS are interior vertical walls or vertical partitions that span the transition in height between adjacent ceilings of different heights.

601.3.1.3.2.2 ~~601.3.1.3.3~~ *[Section 140.6(c)2G]* Area Category Method – Allowed Additional Lighting Power ~~lighting power allowances~~ for qualifying lighting systems in Nonresidential Buildings not Including Group R occupancies and common or public use areas.

In addition to the ~~allowed indoor lighting power~~ Allowed Baseline Lighting Power calculated according to ~~Section 601.3.1.3.2~~ 601.3.1.3.2.1 *[Sections 140.6(c)2~~*A E through F]*, the *building* may add the allowed additional lighting power ~~allowances~~ for qualifying lighting systems as specified in the Qualifying Lighting Systems column in Table 601.3-C *[Table 140.6-C]* under the following conditions:

…

9. Wall decorative/display~~s~~ allowance. Additional allowed power for *wall decorative/display lighting* in a space is ~~available only for *lighting*~~ the lesser of the installed decorative/display lighting that is within 10 feet of ~~illuminates~~ walls in the space and the length of walls multiplied by the wall decorative/display allowance in units of Watts per linear feet of wall specified in Table 601.3-C [Table 140.6-C]. ~~having wall displays~~. The length of ~~display~~ walls shall include the length of the perimeter walls, including but not limited to: closable openings, ~~and~~ permanent full-height interior partitions, and perimeter illuminated *ceiling bulkhead walls* formed by a vertical offset in ceiling heights of three feet and greater . Permanent full-height interior partitions are those that (I) extend from the floor to within two feet of the ceiling or are taller than ten feet, and (II) are permanently anchored to the floor. Qualifying wall *lighting* shall:

9.1 Be mounted within 10 feet of walls. ~~the wall having the wall display~~. ~~When *track lighting* is used for wall display, and where~~ Where portions of ~~that~~ *lighting* track are more than 10 feet from the wall and other portions are within 10 feet of the wall, portions of track more than 10 feet from the wall shall not be used for the wall decorative/display allowance; and

9.2 Be a *lighting* system type appropriate for wall *lighting*. *Lighting* systems appropriate for wall *lighting* are *lighting* track adjacent to the wall, wall-washer *luminaires*, *luminaires* behind a wall valance or wall cove, or accent *light*. (Accent *luminaires* are adjustable or fixed *luminaires* providing directional display *light*.)

…

TABLE 601.3-C1 [TABLE 140.6-C1] AREA CATEGORY METHOD—LIGHTING POWER DENSITY VALUES (WATTS/FT²) FOR NONRESIDENTIAL BUILDINGS NOT INCLUDING *GROUP R OCCUPANCIES AND COMMON USE OR PUBLIC USE AREAS*

Primary Function Areas	Baseline LPD Allowance (W/ft²)	Additional Qualified Lighting System 1	Additional Allowance 1 (W/ft² unless other units)	Additional Qualified Lighting System 2	Additional Allowance 2 (W/ft² unless other units)
~~Retail: Grocery Sales Ceiling Height ≤10'4"~~	~~0.80~~	~~Decorative/Display~~	~~0.45~~	~~Wall decorative/display~~	~~3 W/ft~~
~~Retail: Grocery Sales Ceiling Height >10'5"-14'~~	~~0.85~~	~~Decorative/Display~~	~~0.50~~	~~Wall decorative/display~~	~~5 W/ft~~
~~Retail: Grocery Sales Ceiling Height >14'~~ Retail Grocery Sales	~~0.90~~ 0.85	~~Decorative/Display~~ Decorative/Display	~~0.55~~ 0.65	~~Wall decorative/display~~ NA	~~6 W/ft~~ NA

3.2 ACM Reference Manual

The 2028 Nonresidential ACM Reference Manual, Appendix 5.4A specific to Nonresidential Buildings excluding Group R Occupancies and Common Use or Public Use Areas would need to be updated with the revised grocery LPDs in Table "SpaceFunctionData" in Appendix 5.4A.

The LPDs and additional lighting wattage allowances associated with Group R Occupancies and Common Use or Public Use Areas would be unchanged from the 2025 Nonresidential ACM Reference Manual, Appendix 5.4A.