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Outdoor Lighting

Overview

This chapter covers the Title 24, California Code of Regulations, Part 6 (Energy Code) requirements for nonresidential outdoor lighting systems design, installation, luminaires, and lighting controls. The chapter includes guidance for meeting the Energy Code and also includes installation scenarios with appropriate compliance approaches to meet the Code.

This chapter is addressed primarily to lighting designers, electrical engineers, electrical contractors, energy consultants, manufacturers, local enforcement agency staff, others working on behalf of local government building departments, and others who provide outreach and education of the Energy Code.

The 2025 Energy Code includes some updates that clarify the requirements of motion sensing controls and aid the usage of Table 140.7-B for lighting power allowance for specific applications.

Scope, Approach, and Applications

This chapter applies to all nonresidential outdoor lighting, whether attached to buildings, poles, structures or self-supporting, including, but not limited to, lighting for hardscape areas such as parking lots, lighting for building entrances, lighting for all outdoor sales areas, and lighting for building façades.

The nonresidential outdoor lighting part of the Energy Code includes minimum control requirements, maximum allowable lighting power, and shielding (uplight and glare) zonal lumen limits for outdoor luminaires.

All section and table references in this chapter refer to sections and tables contained in the Energy Code.

Refer to Chapter 7 of this manual for the sign lighting requirements.

Refer to Residential Compliance Manual Chapter 6 for information on lighting requirements for single-family residential buildings.

Refer to Multifamily Compliance Manual Chapter 6 for information on lighting requirements for multifamily buildings.

Outdoor Lighting Power Compliance Approach

Please refer to Chapter 6.2.1 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Lighting Power Trade-Offs

The Energy Code does not allow trade-offs between outdoor lighting power allowances and indoor lighting, sign lighting, heating, ventilation, and air-conditioning (HVAC) system, building envelope, or water heating (Section 140.7(a)).

There is only one type of trade-off permitted for outdoor lighting power. Allowed lighting power determined according to Section 140.7(d)1 and Table 140.7-A for general hardscape lighting may be traded to specific applications in Section 140.7(d)2 and Table 140.7-B,

provided the luminaires used to determine the illuminated area are installed as designed. This means that if luminaires used to determine the total illuminated area are removed from the design, resulting in a smaller illuminated area, then the general hardscape lighting power allowance must also be reduced accordingly.

Allowed lighting power for specific applications may not be traded between specific applications or to hardscape lighting in Section 140.7(d)1. This means that for each specific application, the allowed lighting power is the smaller of the allowed power determined for that specific application according to Section 140.7(d)2, or the actual installed lighting power that is used in that specific application. These additional power allowances are "use it or lose it" allowances.

Table 6-1: Scope of the Outdoor Lighting Requirements

Lighting Applications Covered **General Hardscape (trade-offs permitted)**	**Lighting Applications Covered** **Specific Applications (trade-offs not permitted)**	**Lighting Applications Not Regulated** **(only as detailed in Section 140.7)**
The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated.	Canopies: Sales and Non-sales; Tunnels; Vehicle Service Station: Canopies, Hardscape, and Uncovered Fuel Dispensers; Drive-Up Windows; Building Entrances or Exits; Building Facades; Guard Stations; Hardscape Ornamental Lighting; Outdoor Dining; Primary Entrances to Senior Care Facilities, Police Stations, Healthcare Facilities, Fire Stations, and Emergency Vehicle Facilities; Outdoor Sales Lots and Frontage; Student Pick-up/Drop-off zones;	Temporary outdoor lighting. Required and regulated by the Federal Aviation Administration (FAA) and the Coast Guard. For public streets, roadways, highways, and traffic signage lighting, and lighting for driveway entrances occurring in the public right-of-way. For sports and athletic fields, and children's playground. For industrial sites. For public monuments. Signs regulated by Section 130.3 and Section 140.8. For stairs, and wheelchair elevator lifts for American with Disabilities Act compliance. For ramps that are not parking garage ramps.

	ATM Lighting; Special Security Lighting for Retail Parking and Pedestrian Hardscape; and Security Cameras.	Landscape lighting. For themes and special effects in theme parks. For outdoor theatrical and other outdoor live performances. For qualified historic buildings.

Source: California Energy Commission

Other outdoor lighting applications that are not included in Energy Code Tables 140.7-A or 140.7-B are assumed to be not regulated by the Energy Code. This includes decorative gas lighting and emergency lighting powered by an emergency source as defined by the California Electrical Code. The text in the above list of lighting applications that are not regulated has been shortened for brevity. Please see Outdoor Lighting Applications Not Regulated by Section 140.7 for details about unregulated lighting applications.

Outdoor Lighting Applications Not Regulated by Section 140.7

When a luminaire is installed only to illuminate one or more of the following applications, the lighting power for that luminaire shall not be required to comply with the lighting power requirements in Section 140.7(a). Refer to the right column of Table 6- 1: Scope of the Outdoor Lighting Requirements for a quick reference to the lighting applications that are not required. Also, the Energy Code clarifies that at least 50 percent of the light from the luminaire must fall within an application to qualify as being installed for that application.

Outdoor Lighting Zones

Reference: Section 10-114(a), Section 10-114(b), Section 10-114(c)

The Energy Code allows outdoor lighting power based on the brightness of the surrounding conditions. Lighting power allowances for new lighting installations and specific alterations depend on the lighting zone (LZ) in which the project is located.

The outdoor lighting zones types as defined are: LZ0, LZ1, LZ2, LZ3, and LZ4. LZ0 is intended for undeveloped spaces in parks and wildlife preserves and is very low ambient illumination - such as in national parks and other areas intended to be very dark at night. LZ1 is assigned with the least power, and increasingly more power is allowed in LZ2, LZ3, and LZ4. LZ1, LZ2, and LZ3 are designated according to 2020 U.S. Census definitions for rural areas and urban areas. LZ4 is intended for high-intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.

The eyes adapt to darker surrounding conditions, and less light is required to properly see. When the surrounding conditions get brighter, more light is needed to see. Providing greater power than is needed potentially leads to debilitating glare and an increasing spiral of

brightness as overbright projects populate surrounding conditions causing future projects to unnecessarily require greater power resulting in wasted energy.

Table 10-114-A tabulates the statewide default locations for outdoor lighting zones. See Parks, Recreation Areas, and Wildlife Preserves (Very Low Ambient Illumination) through Urban Areas (With Moderately High Ambient Illumination) for narratives about outdoor lighting zone types and Determining the Lighting Zone for an Outdoor Lighting Project for how to determine their designations.

Parks, Recreation Areas, and Wildlife Preserves (Very Low Ambient Illumination)

Please refer to Chapter 6.3.1 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Rural Areas (Low Ambient Illumination)

Please refer to Chapter 6.3.2 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Urban Areas (With Moderate Ambient Illumination)

The default lighting zone for urban areas as defined by the U.S. Census Bureau is Lighting Zone 2 and it depends on what the building types are located on the zone for the determination of Lighting Zone 2. For example, an urban area with multifamily housing, mixed use residential neighborhoods, religious facilities, schools, light commercial business districts, and industrial zoning districts is deemed (defaulted) to be in Lighting Zone 2.

However, local jurisdictions may designate certain areas as either Lighting Zone 3 or Lighting Zone 4. Examples of areas that might be designated Lighting Zone 3 are special commercial districts or areas with special security considerations located within a mixed-use residential area or city center.

Local jurisdictions also may designate default Lighting Zone 2 areas as Lighting Zone 1, which would establish lower lighting power for outdoor areas with lower surrounding brightness. An example of an area that might be changed to Lighting Zone 1 would include an undeveloped, environmentally sensitive, or predominately residential area within a default Lighting Zone 2 area.

Urban Areas (With Moderately High Ambient Illumination)

Lighting Zone 3 is the default for urban areas, as defined by the U.S. Census Bureau and it depends on what the building types are located on the zone for the determination of Lighting Zone 3. For example, an urban area with high intensity commercial corridors, entertainment centers, heavy industrial zone districts, and manufacturing zone districts is deemed to be in Lighting Zone 3. Local jurisdictions may designate areas as Lighting Zone 4 for high-intensity nighttime use, such as entertainment, commercial districts, or areas with special security considerations requiring very high light levels.

Local jurisdictions also may designate default Lighting Zone 3 areas as Lighting Zone 2 or Lighting Zone 1 if deemed appropriate.

Determining the Lighting Zone for an Outdoor Lighting Project

Permit applicants may determine the lighting zone for a particular property using the following steps.

For government-designated parks, recreation areas, wildlife preserves and Lighting Zone 4 (LZ4):

- Check with the local jurisdiction having authority over permitting of the property. The local jurisdiction will know if the property is a government-designated park, recreation area, or wildlife preserve, and therefore in default Lighting Zone 0 or 1. The local jurisdiction also may know if the property is contained within the physical boundaries of a lighting zone for which a locally adopted change has been made.

For urban areas and rural areas:

- The lighting zones for urban areas and rural areas as well as the legal boundaries of wilderness and park areas are based on the 2020 U.S. Census Bureau boundaries.
- The U.S. Census Bureau website can be used to determine if the property is within rural areas or urban areas – a rural area is defaulted as Lighting Zone 1 (LZ1), an urban area is defaulted as Lighting Zone 2 or 3. Using an online tool provided by the U.S. Census Bureau on https://geocoding.geo.census.gov/geocoder/geographies/address?form can be entered to look up geography results indicating whether the address is within a rural area or an urban area. Figure 6-1: Example-1 of U.S. Census Bureau Tool, Figure 6-2: Example-2 of U.S. Census Bureau Tool, and Figure 6-3: Example-3 of U.S. Census Bureau Tool shows screen images of using the U.S. Census Bureau online tool.

Figure 6-1: Example-1 of U.S. Census Bureau Tool

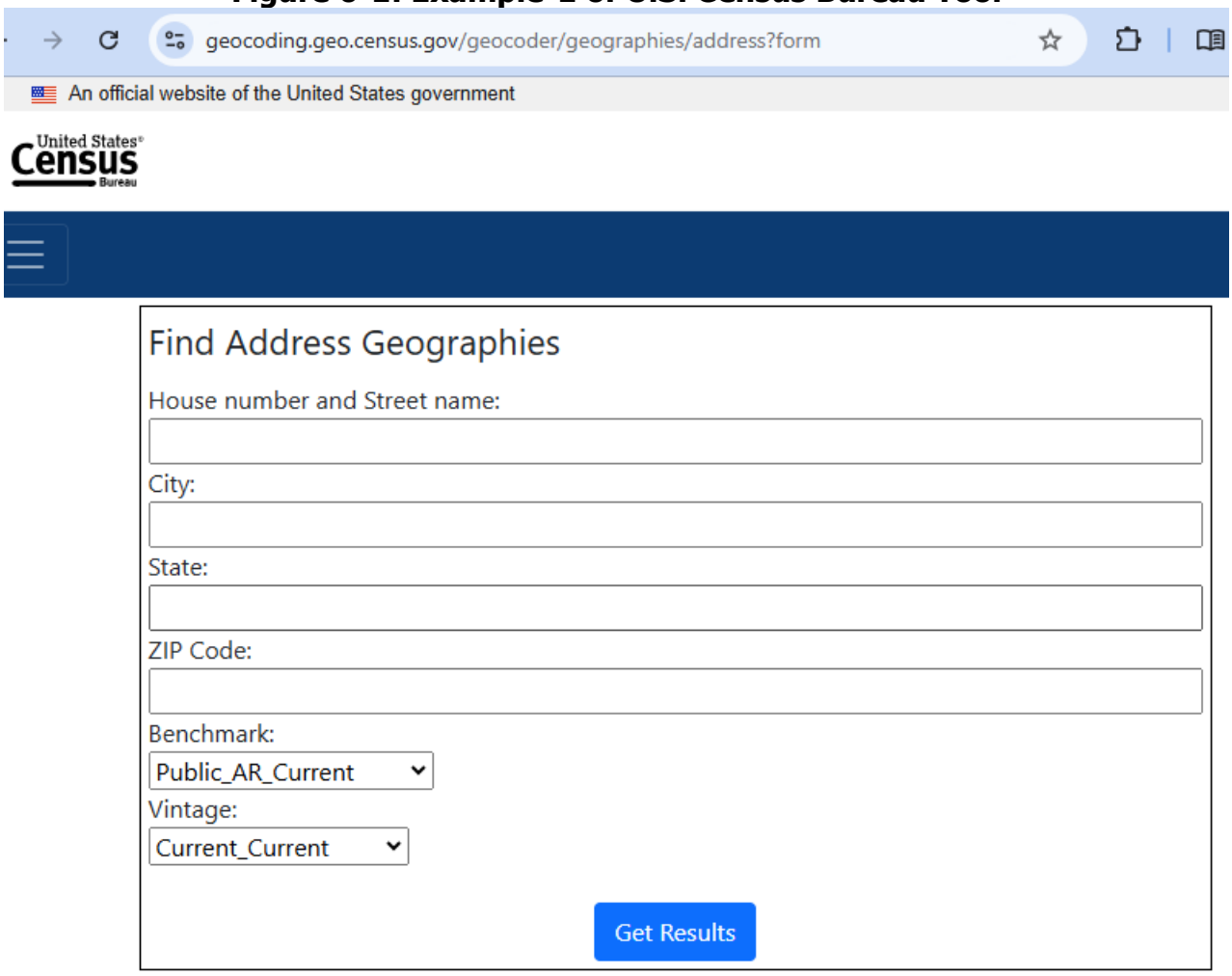


Image Source: California Energy Commission (the image is extracted from the U.S. Census Bureau website)

Figure 6-2: Example-2 of U.S. Census Bureau Tool

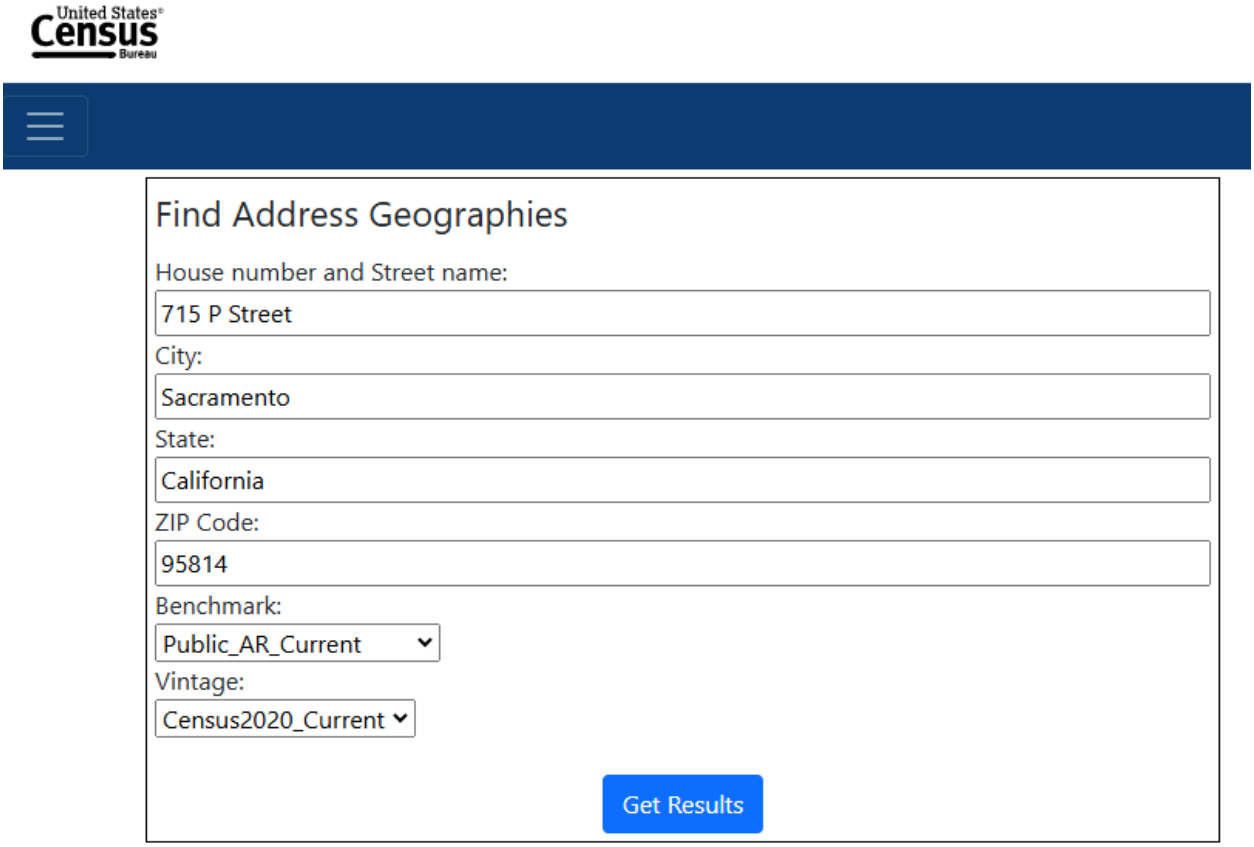


Image Source: California Energy Commission (the images are extracted from the U.S. Census Bureau website)

Figure 6-3: Example-3 of U.S. Census Bureau Tool

Image Source: California Energy Commission (the images are extracted from the U.S. Census Bureau website)

Lighting Zone Adjustments by Local Jurisdictions

Reference: Section 10-114, Table 10-114-A

The CEC sets statewide default lighting zones. However, local jurisdictions (usually a city or county) may change lighting zones to accommodate local conditions. A local jurisdiction may designate a portion of Lighting Zones 2 or 3 as Lighting Zone 3 or 4. The local jurisdiction also may designate a portion of Lighting Zone 3 to Lighting Zone 2 or even Lighting Zone 1. When a local jurisdiction adopts changes to the lighting zone boundaries, it must follow a public process that allows for formal public notification, review, and comment about the proposed change.

Example 6-1: Changing the Default Lighting Zone

Question:

I want to have the default outdoor lighting zone for a particular piece of property changed. How do I accomplish that?

Answer:

Check with the local jurisdiction having authority over the property and ask them how to petition to have the default outdoor lighting zone officially adjusted.

Mandatory Requirements

Please refer to Chapter 6.4 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Luminaire Shielding and CALGreen BUG Requirements

Reference: Section 130.2(b)

The Energy Code includes outdoor luminaire shielding requirements based on the luminaire's initial lumen rating. All outdoor luminaires that emit 6,200 initial lumens or greater must comply with backlight, uplight, and glare (BUG) requirements contained in Section 5.106.8 of the CALGreen Code (Title 24, Part 11).

The BUG ratings assume that the light emitted from the luminaire is providing useful illuminance on the task surfaces rather than scattering the light in areas where the light is not needed or intended, such as toward the sky. These BUG ratings also increase visibility because high amounts of light shining directly into observer's eyes are reduced, thus decreasing glare. Additionally, light pollution into neighbors' properties is reduced. The BUG requirements vary by outdoor lighting zones, which are described in Outdoor Lighting Zones.

Luminaire manufacturers are aware of the technical details of the BUG ratings and typically provide the BUG ratings for their luminaires in product specifications or cutsheets. In the rare occasions where the luminaire manufacturer does not provide a BUG rating, it can be calculated with outdoor lighting software if the luminaire photometric data is available.

There are exceptions to the luminaire shielding and the BUG rating requirements in CALGreen and the Energy Code.

The following are the exceptions in CALGreen Section 5.106.8: (The information is extracted from the CALGreen Code):

- Luminaires that qualify as exceptions in Sections 130.2(b) and 140.7 of the California Energy Code
- Emergency lighting
- Building façade meeting the requirements in Table 140.7-B of the California Energy Code, Part 6
- Custom features as allowed by the local enforcing agency, as permitted by Section 101.8 Alternate materials, designs and methods of construction (of the CALGreen Code).
- Luminaires with less than 6,200 initial luminaire lumens

The following are exceptions in Section 130.2 of the Energy Code for outdoor lighting applications that are not required to meet the luminaire shielding requirements. In some of these applications, lighting directed sideways and upwards may be desirable.

- Signs.
- Lighting for building façades, public monuments, public art, statues, and vertical surfaces of bridges.
- Lighting required by a health or life safety statute, ordinance, or regulation that may fail to meet the uplight and glare limits due to application limitations.
- Temporary outdoor lighting that does not persist beyond 60 consecutive days or more than 120 days per year.
- Replacement of existing pole mounted luminaires in hardscape areas that are spaced more than six times the mounting height of the existing luminaires and the replacement luminaire wattage is less than or equal to the wattage of the original luminaires. In addition:
    - Where the existing luminaire does not meet the BUG requirements in Section 130.2(b).
    - Where no additional poles are being added to the site.
    - Where new wiring to the luminaires is not being installed.
- Luminaires that light the public right of way including publicly maintained or utility-maintained roads, sidewalks, or bikeways.
- Luminaires that qualify as exceptions in Section 140.7(a).

In addition, a local ordinance may have a more stringent outdoor lighting BUG requirements than that of the CALGreen Code — the local ordinance would govern the outdoor lighting BUG requirements in that scenario.

Example 6-2

Question:

Which outdoor lighting are not required to meet the CALGreen requirements in Section 5.106.8?

Answer:

Certain categories of outdoor lighting luminaires are not required to meet the light pollution reduction requirements of CALGreen Code Section 5.106.8, and they are as follows.

First, outdoor lighting luminaires with less than 6,200 initial luminaire lumens are not required.

Second, listed below are additional outdoor lighting luminaires which are also not required. (Listed below are for a quick reference. For more details, see the box further below.)

- Outdoor lighting with custom features as allowed by Section 5.106.8 of the California CALGreen Code.
- Outdoor luminaires that are not required to meet as specified in Section 130.2(b) and Section 140.7 of the California Energy Code.
- Building façade lighting indicated in Table 140.7-B of the California Energy Code.
- Emergency lighting.

Example 6-3

Question:

How do you determine the glare rating for a luminaire located in Lighting Zone 3?

Reference:

(Relevant information extracted from the CALGreen Code and they are included here for reference.)

CALGreen 5.106.8.2 Facing – Glare.

For luminaires covered by Section 5.106.8.1 of the CALGreen Code, if a property line also exists within or extends into the front hemisphere within two mounting heights (2 MH) of the luminaire, then the luminaire shall comply with the more stringent glare rating specified in Table 5.106.8 based on the lighting zone and distance to the nearest point on the nearest property line within the front hemisphere.

Figure 6-4: CALGreen Table 5.106.8

TABLE 5.106.8 [N]
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS[1,2]

	ALLOWABLE RATING	LIGHTING ZONE LZ0	LIGHTING ZONE LZ1	LIGHTING ZONE LZ2	LIGHTING ZONE LZ3	LIGHTING ZONE LZ4
>	**Maximum Allowable Backlight Rating (B)**					
	Luminaire greater than 2 mounting heights (MH) from property line	N/A	No Limit	No Limit	No Limit	No Limit
	Luminaire back hemisphere is 1 – 2 MH from property line	N/A	B2	B3	B4	B4
	Luminaire back hemisphere is 0.5 – 1 MH from property line	N/A	B1	B2	B3	B3
	Luminaire back hemisphere is less than 0.5 MH from property line	N/A	B0	B0	B1	B2
	Maximum Allowable Uplight Rating (U)					
	For area lighting[3]	N/A	U0	U0	U0	U0
	For all other outdoor lighting, including decorative luminaires	N/A	U1	U2	U3	U4
>	**Maximum Allowable Glare Rating (G)**					
	Luminaire greater than 2 MH from property line	N/A	G1	G2	G3	G4
	Luminaire front hemisphere is 1 – 2 MH from property line	N/A	G0	G1	G1	G2
	Luminaire front hemisphere is 0.5 – 1 MH from property line	N/A	G0	G0	G1	G1
	Luminaire front hemisphere is less than 0.5 MH from property line	N/A	G0	G0	G0	G1

1. IESNA Lighting Zones 0 are not applicable; refer to Lighting Zones as defined in the *California Energy Code* and Chapter 10 of the *California Administrative Code*.
2. For property lines that abut public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.
> 3. General lighting luminaires in areas such as outdoor parking, sales or storage lots shall meet these reduced ratings. Decorative luminaires located in these areas shall meet *U*-value limits for "all other outdoor lighting."
>

5.106.8.1 Facing – Backlight.

Images Source: California Energy Commission. (The information is extracted from the CALGreen Code and included here for reference.)

Answer:

Start by looking up Table 5.106.8 of CALGreen Code.

Refer to Column 5 for Lighting Zone 3. The top rows show the backlight rating, the two rows in the middle show the uplight rating, and the bottom rows show the glare rating.

Next, determine the glare rating from the bottom rows and locate the values from Column 5.

See below for a summary of information related to the luminaires in this example for Lighting Zone 3.

Figure 6-5: Extract From CALGreen Code

Luminaire greater than 2 mounting heights (MH) from property line	Glare rating of G3 or less
Luminaire back/front hemisphere is 1 — 2 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is 0.5 — 1 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is less than 0.5 MH from property line	Glare rating of G0 or less

Images Source: California Energy Commission. (The information is extracted from the CALGreen Code and included here for reference to the above example.)

The maximum allowable glare rating for Lighting Zone 3 ranges from G3, G2, G1, and G0 and the glare rating would depend on the location of the luminaire from a property line.

The glare rating is the maximum allowable rating and therefore any rating that is less than the maximum rating is also allowed. For luminaires located greater than two mounting heights from a property line, a luminaire with a glare rating of G3, G2, G1, or G1 meets the requirement.

Example 6-4

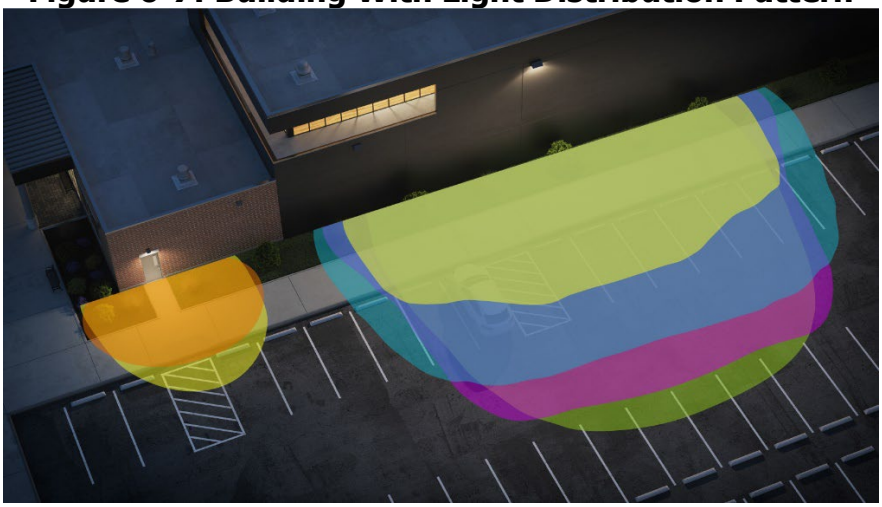
Question:

How do you determine glare requirements for the luminaires shown in the pictures below and are located in Lighting Zone 3?

Figure 6-6: Building With Wall-Mounted Luminaires

Source: courtesy of Lithonia Lighting, a part of Acuity Brands Lighting & Controls.

Figure 6-7: Building With Light Distribution Pattern



Source: courtesy of Lithonia Lighting, a part of Acuity Brands Lighting & Controls.

Answer:

First, determine if the luminaire is located within two mounting heights (2 MH) of distance from property line, and refer to Table 5.106.8 of the CALGreen code for the allowable glare rating.

If the distance is greater than 2 MH, the glare rating of the luminaire must be G3 or less (i.e., G2, G1 or G0).

If the distance is within one to two mounting heights (MH) of distance from the property line, the glare rating of the luminaire must be G1 or less (i.e., G0).

Similarly, if the distance is within a half to one mounting height of distance from the property line, the glare rating of the luminaire must be G1 or less (i.e., G0).

If the distance is less than a half mounting height of distance from the property line, the glare rating of the luminaire must be G0.

The above could also be summarized in a tabular format as follows.

Figure 6-8: Extract From CALGreen Code

Luminaire greater than 2 mounting heights (MH) from property line	Glare rating of G3 or less
Luminaire back/front hemisphere is 1 — 2 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is 0.5 — 1 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is less than 0.5 MH from property line	Glare rating of G0 or less

Source: California Energy Commission. (The information is extracted from the CALGreen Code Table 150.6.8 and included here for reference to the above example.)

Example 6-5

Question:

How do you determine backlight requirements for the luminaire shown in the picture below and the luminaires are located in Lighting Zone 3?

Figure 6-9: Picture of Luminaires on Light Pole

Source: courtesy of Lithonia Lighting, a part of Acuity Brands Lighting & Controls.

Reference:

(This information below is extracted from the CALGreen Code and included here for reference.)

CALGreen 5.106.8.1 Facing — Backlight
Luminaires within two mounting heights (2 MH) of a property line shall be oriented so that the nearest property line is behind the fixture and shall comply with the backlight rating specified in Table 5.106.8 based on the lighting zone and distance to the nearest point of that property line.
Exception: Corners. If two property lines (or two segments of the same property line) have equidistant points to the luminaire, then the luminaire may be oriented so that the intersection of the two lines (the corner) is directly behind the luminaire. The luminaire shall still use the distance to the nearest point(s) on the property lines to determine the required backlight rating.

Figure 6-10: CALGreen Table 5.106.8

TABLE 5.106.8 [N]
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS[1,2]

	ALLOWABLE RATING	LIGHTING ZONE LZ0	LIGHTING ZONE LZ1	LIGHTING ZONE LZ2	LIGHTING ZONE LZ3	LIGHTING ZONE LZ4
>	**Maximum Allowable Backlight Rating (B)**					
	Luminaire greater than 2 mounting heights (MH) from property line	N/A	No Limit	No Limit	No Limit	No Limit
	Luminaire back hemisphere is 1 – 2 MH from property line	N/A	B2	B3	B4	B4
	Luminaire back hemisphere is 0.5 – 1 MH from property line	N/A	B1	B2	B3	B3
	Luminaire back hemisphere is less than 0.5 MH from property line	N/A	B0	B0	B1	B2
	Maximum Allowable Uplight Rating (U)					
	For area lighting[3]	N/A	U0	U0	U0	U0
	For all other outdoor lighting, including decorative luminaires	N/A	U1	U2	U3	U4
>	**Maximum Allowable Glare Rating (G)**					
	Luminaire greater than 2 MH from property line	N/A	G1	G2	G3	G4
	Luminaire front hemisphere is 1 – 2 MH from property line	N/A	G0	G1	G1	G2
	Luminaire front hemisphere is 0.5 – 1 MH from property line	N/A	G0	G0	G1	G1
	Luminaire front hemisphere is less than 0.5 MH from property line	N/A	G0	G0	G0	G1

1. IESNA Lighting Zones 0 are not applicable; refer to Lighting Zones as defined in the *California Energy Code* and Chapter 10 of the *California Administrative Code*.
2. For property lines that abut public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.
> 3. General lighting luminaires in areas such as outdoor parking, sales or storage lots shall meet these reduced ratings. Decorative luminaires located in these areas shall meet *U*-value limits for "all other outdoor lighting."
>

5.106.8.1 Facing – Backlight.

Images Source: California Energy Commission. (The information is extracted from the CALGreen Code and included here for reference.)

(The above information is extracted from the CALGreen Code and included here for reference.)

Answer:

First, if the luminaire is located at more than two mounting height (2 MH) of distance from the property line, there is no mandatory backlight rating (no limit on backlight) for the luminaire.

For a luminaire located within two mounting height (2 MH) of distance from the property line and that is not exempt, the luminaire must comply with the backlight rating listed in Table 5.106.8.

For a luminaire located in Lighting Zone 3 (LZ3) and within one to two mounting heights (MH) of distance from the property line, the backlight rating of the luminaire must be B4 or less (i.e., B3, B2, B1 or B0).

For the same luminaire in LZ3 and within a half to one mounting height of distance from the property line, the backlight rating of the luminaire must be B3 or less (i.e., B2, B1 or B0).

For the same luminaire in LZ3 and located less than a half mounting height of distance from the property line, the backlight rating of the luminaire must be B1 or less (i.e., B0).

The above information could also be summarized in a tabular format below.

Figure 6-11: Extract From CALGreen Code

Luminaire greater than 2 mounting heights (MH) from property line	No limit
Luminaire back hemisphere is 1 - 2 MH from property line	B4 or less
Luminaire back hemisphere is 0.5 - 1 MH from property line	B3 or less
Luminaire back hemisphere is less than 0.5 MH from property line	B1 or less

Images Source: California Energy Commission. (The information is extracted from the CALGreen Code Table 150.6.8 and included here for reference to the above example.)

(This information is extracted from the CALGreen Code.)

Example 6-6: Defining the Property Line for the Purpose of BUG Rating Compliance

Question:

Where is the property line if the area under construction is located next to a public road?

Answer:

For a property line that abuts a public roadway or transit corridor, the property line may be the centerline of the public roadway or transit corridor.

For a property line that is next to a public walkway, bikeway, plaza, or parking lot, the property line may be 5 feet beyond the actual property line.

Example 6-7: Luminaire Classification for Outdoor Luminaires

Question:

What is the IES BUG system for outdoor luminaires?

Answer:

Illuminating Engineering Society (IES) published the technical memorandum 'Luminaire Classification for Outdoor Luminaires' (document TM-15-20). This document defines three-dimensional regions of analysis for exterior luminaires and further establishes zonal lumen

limits for these regions as part of a larger method of categorizing outdoor lighting equipment into backlight, uplight, and glare components. Collectively, the three components are referred to as the BUG system.

The zonal lumen limits per secondary solid angles for uplight and glare are based upon the methodology found in TM-15. The lighting zone in which the project is located determines the maximum zonal lumens for backlight, uplight, and glare.

To comply with this mandatory measure, the luminaire must not exceed the maximum zonal lumen limits for each secondary solid angle region per lighting zone. The zonal lumen values in a photometric test report must include any tilt or other nonlevel mounting condition of the installed luminaire. The BUG rating requirements can be found in CALGreen Code Section 5.106.8.

The BUG rating for luminaires may be determined with outdoor lighting software or by contacting the manufacturer. There is also software available to produce a BUG rating for a tilted luminaire condition (which is not a typical circumstance for most applications). Since the California BUG limits and calculation procedures match the IES, no deviation from the IES BUG rating is necessary.

Example 6-8: Wallpacks and Zonal Lumen Limits

Question:

A new parking lot adjacent to a building is being designed to be illuminated by wall packs rated at 7,000 initial luminaire lumens. The wall packs are mounted on the side of the building, and their main purpose is parking lot illumination. But they are also illuminating the façade of the building. Do these wall packs have to meet the backlight, uplight, and glare (BUG) rating limits?

Answer:

Yes, these 7,000 lumen wall packs will have to meet the BUG rating requirements because the main purpose is parking lot illumination. Luminaire mounting methods or locations do not necessarily determine the purpose of the illumination. Define the function of the luminaire by determining what the majority of the light is striking. For a typical wall pack, 80% or more of the light is likely striking the parking lot or sidewalk in front of the building, and only 20% or less on the façade, so BUG rating limits apply.

Each luminaire must be appropriately assigned to the function area that it is illuminating, whether it is mounted to a pole, building, or other structure. Only luminaires that are rated less than 6,200 initial luminaire lumens or outdoor lighting applications that are not required to meet the backlight, uplight, and glare (BUG) requirements in the Energy Code.

Example 6-9: Tilted Luminaires Meeting the BUG Requirements

Question:

If a low BUG rating luminaire is mounted at a tilt, does it still meet the BUG requirements?

Answer:

It depends. Luminaires that meet the zonal lumen limits when mounted at 90° to nadir may or may not comply with the BUG rating limits when they are mounted at a tilt.

For a tilted luminaire to meet this requirement, a photometric test report must be provided showing that the luminaire meets the zonal lumen limits at the proposed tilt. There are lighting design software available to calculate a BUG rating for a tilted luminaire, or this can be provided by the manufacturer.

Requirements for Outdoor Lighting Controls

Reference: Section 130.2(c)

The primary requirements for outdoor lighting controls are as follows:

- Daylight Availability: All outdoor lighting shall be automatically controlled so that lighting is off when daylight is available (Section 130.2(c)1).
- Automatic Scheduling Controls: All outdoor lighting shall be automatically controlled by a time-based scheduling control (Section 130.(c)2).
- Motion-Sensing Controls: Outdoor luminaires greater than 40 watts and mounted 24 ft or less above the ground shall be controlled by motion-sensing controls. This applies to luminaires providing general hardscape lighting, outdoor sales lot lighting, vehicle service station hardscape lighting, or vehicle service station canopy lighting (Section 130.2(c)3).

Outdoor lighting control requirements do not apply to any of the following lighting applications:

- Lighting where a health or life safety statute, ordinance, or regulation prohibits outdoor lighting to be turned OFF or reduced.
- Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

Example 6-10: Circuiting of Non-Outdoor Lighting Load

Question:

Can irrigation controllers be on the same power circuit as lighting?

Answer:

The outdoor lighting load may be on the same circuit with other electrical loads if the outdoor lighting load is independently controlled from all other electrical loads.

Daylight Availability

Reference: Section 130.2(c)1

All installed outdoor lighting must be controlled by a photocontrol, astronomical time-switch control, or other controls that automatically turns off the outdoor lighting when daylight is available.

- A photocontrol measures the amount of ambient light outdoors. When the light level outside is high enough to indicate that it is daytime, the control turns lighting off.
- Astronomical time-switch controls require an initial setup of the time clock device, which may include the entry of the current date and time (and time zone), site location (by longitude and latitude), and whether daylight saving time is applicable. The clock calculates sunrise and sunset times (which vary by location and day of the year) and turns lighting off at sunrise and on at sunset.

Astronomical time switches are time-based controls that can be used to meet the daylight availability and automatic scheduling control requirements.

Automatic Scheduling Controls

Reference: Section 130.2(c)2

All installed outdoor lighting shall be controlled by an automatic scheduling control capable of reducing lighting power by 50 to 90 percent and separately capable of turning lighting off when not needed according to a schedule.

Further, automatic scheduling controls are required to have the capability of programming at least two nighttime periods (a scheduled occupied period and a scheduled unoccupied period) with different light levels, if desirable by the building design and operation.

Automatic scheduling controls provide flexibility to accommodate changes in building operation. If different operating schedules or different lighting levels are desired, the settings of the automatic scheduling controls can be adjusted.

There are applications in which there are benefits to employ both motion-sensing controls and automatic scheduling controls. Some lighting applications will require both control types.

Example 6-11: Using Automatic Scheduling Controls Plus Some Other Controls

Question:

Can motion-sensing controls be used together with automatic scheduling controls?

Answer:

Some applications require the installation of motion-sensing controls. For these applications, automatic scheduling controls are required in addition to motion-sensing controls. During the scheduled occupied period, motion-sensing controls can detect occupancy of an outdoor space and turn on or reduce lighting based on the occupancy of the space. During the scheduled unoccupied period, the automatic scheduling control can turn off all lighting.

Example 6-12: Using Automatic Scheduling Controls for Buildings That Operate 24x7

Question:

Is the automatic scheduling control requirement applicable to a building occupied 24 hours per day, seven days per week?

Answer:

Yes, automatic scheduling controls are required for buildings that are occupied 24 hours per day, seven days per week.

Business activities can change over time as business models and hours of operation evolve. The required nighttime periods of a scheduled occupied period and a scheduled unoccupied period are decided by the building owner or the building operator, as appropriate, to suit the business needs.

Acceptance Tests Required for Automatic Scheduling Controls

Outdoor automatic scheduling controls are required to have acceptance testing conducted to confirm the appropriate schedules are programmed and the controls operate per the programmed schedule. The acceptance test procedures are detailed in Reference

Nonresidential Appendix NA7.8.5. Refer to Acceptance Testing of this manual for details about outdoor lighting controls acceptance test.

Motion-Sensing Controls

Reference: Section 130.2(c)3

Outdoor luminaires greater than 40 watts, where the bottom of the luminaire is mounted 24 ft. or less above the ground, shall be operated with motion-sensing controls if they are used in the following applications:

- General hardscape lighting including parking lot lighting.
- Lighting for vehicle service station hardscape and vehicle service station canopy
- Lighting for outdoor sales lots, sales canopies, and non-sales canopies

The motion sensing controls shall:

- Be capable of reducing the lighting power of each luminaire by 50 to 90 percent, and separately be capable of turning the luminaire off during unoccupied periods.
- Be capable of reducing the lighting to the dim or off state within 15 minutes of vacancy detection and turning the lighting back on upon occupancy.
- Control no more than 1,500 watts of lighting power by a single sensor or as a single zone.

Exceptions to Motion-Sensing Control Requirements

Luminaires serving the following applications are not required to have motion-sensing controls:

- Lighting for building façades, ornamental hardscape, and outdoor dining.
- Luminaires with a rated wattage of 40 watts or less.
- Building mounted luminaires, pole-mounted luminaries, and other outdoor luminaires mounted greater than 24 feet above grade.
- Lighting subject to health or life safety statute, ordinance, or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent.

In addition, the lighting applications listed as exceptions to Section 140.7(a) are not required to meet the motion controls requirements of Section 130.2(c)3 when more than 50 percent of the light is from a luminaire of the listed lighting application. The applications include temporary outdoor lighting, lighting of signs, lighting for public monuments, and landscape lighting. The complete listing can be found in Section 140.7(a). Exempt lighting applications are also provided in Table 6-1: Scope of the Outdoor Lighting Requirements.

Acceptance Tests Required for Motion-Sensing Controls

Motion-sensing controls are required to have an acceptance testing conducted to confirm that the sensor can sense activity within the detection zone and turn lighting on when occupancy is detected and reduce or turn lighting off within 15 minutes of vacancy detected. The acceptance test procedures are detailed in Reference Nonresidential Appendix NA7.8.1. Refer

to Acceptance Testing of this manual for details about outdoor lighting controls acceptance test.

Lighting Control Functionality

Please refer to Chapter 6.4.3 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Prescriptive Requirements

Outdoor Lighting Power Compliance

Please refer to Chapter 6.5.1 of the *2022 Nonresidential and Multifamily Compliance Manual*.

General Hardscape Lighting Power Allowance

The general hardscape allowance is calculated based on the general hardscape area, perimeter length, and lighting zone that the property is located in.

Calculation of Allowed Lighting Power — General Hardscape Lighting Power Allowance

Hardscape is defined in Section 100.1 as an improvement to a site that is paved and has other structural features, including, but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

Determine the general hardscape lighting power allowances as follows:

- The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines, or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the area wattage allowance (AWA) from Table 140.7-A for the appropriate lighting zone.
- Determine the perimeter length of the general hardscape area. The total hardscape perimeter is the length of the actual perimeter of the illuminated hardscape on the property. It shall not include portions of hardscape that are not illuminated according to Section 140.7(d)1A. Multiply the hardscape perimeter by the linear wattage allowance (LWA) for hardscape from Table 140.7-A for the appropriate lighting zone. Generally, if there is an enclosed exclusion in the area AWA calculation, the perimeter may be included in the LWA calculation.
- The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:
    - Landscaped areas completely enclosed within the hardscape area, and with a width or length a minimum of 10 feet wide, shall have the perimeter of the

landscaped areas or permanent planter added to the hardscape perimeter length.

    - Landscaped areas completely enclosed within the hardscape area, and with a width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
    - Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.
- Determine the initial wattage allowance (IWA). The IWA can be used one time per site. The purpose is to provide additional watts for small sites, or for odd hardscape geometries. Add the IWA for general hardscape lighting from Table 140.7-A for the appropriate lighting zone.
- The general hardscape lighting allowance shall be the sum of the allowed watts determined from the first three bullet points above.

Refer to Outdoor Lighting Power Compliance Approach for a concept layout of the general hardscape lighting allowance for area, and perimeter, as well as initial wattage allowance.

The allowed lighting power for general hardscape lighting is calculated using the following components:

- Area wattage allowance (AWA), which is expressed in watts per sq. ft.
- Linear wattage allowance (LWA), which is expressed in watts per linear foot.
- Initial wattage allowance (IWA), which is a flat allowance for each property and is expressed in watts.

To determine the total allowed power for general hardscape lighting, use the equation:

- General Hardscape Lighting Power Allowance = (Hardscape Area x AWA) + (Perimeter Length of Hardscape Area x LWA) + IWA

Example 6-15: Outdoor Lighting for Healthcare Facilities

Question:

Is the parking lot outside of a healthcare facility ("I" occupancy) regulated by the Energy Code?

Answer:

Healthcare facilities overseen by the California Department of Health Care Access and Information (HCAi) (previously California Office of Statewide Health Planning and Development (OSHPD must comply with California Energy Code including the outdoor lighting requirements for all outdoor areas of healthcare facilities. For outdoor lighting, a licensed healthcare facility must meet the outdoor lighting power requirements as specified in Section 140.7 as well as the outdoor lighting control requirements in Section 130.2.

Example 6-16: Hardscape Materials for Parking Lots

Question:

Our overflow parking lot is covered with gravel. Is this parking lot considered "hardscape," and must it comply with the Energy Code?

Answer:

Yes, parking lots covered with gravel, or any other material used to enhance the surface to accommodate parking or travel, such as pavers, asphalt, cement, deck board, or other pervious or impervious materials are considered hardscape and must comply with the requirements for hardscape areas. Note that the updates to 140.7-A now cover all hardscape materials to the same power allowances.

Example 6-17: Power Allowance for a Parking Lot

Question:

In a parking lot in front of a retail store, we are not using the full general lighting power allowed according to Table 140.7-A. Can we use the remaining allowance to illuminate the building entrance and the walkways near the store to a higher level?

Answer:

Yes. Because the general hardscape power allowance is tradable, you may use the unused portion of the power allowance from the parking lot to increase the illumination levels for other lighting applications, including building entrance and walkway areas.

Example 6-18: Calculating the Illuminated Area of a Parking Lot

Question:

A parking lot is illuminated by five cut-off wall packs mounted to an adjacent building. The parking lot extends 100 ft. from the building. The luminaires are mounted at a height of 15 ft. above the ground and spaced 50 ft. apart. How large is the illuminated area?

Answer:

The illuminated area extends a distance equal to five times the mounting height in three directions. (The fourth direction is not counted because it is obstructed by the building.) The illuminated area, therefore, extends from the building 75 ft. The total illuminated area is 75 ft. x 350 ft. or 26,250 $ft.^2$

Example 6-19: Calculating the Illuminated Area

Question 1:

If a pole-mounted luminaire has a height of 15 ft., what are the dimensions of the illuminated area used for power calculations?

Answer 1:

The illuminated area is defined as any area within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height, with the luminaire in the middle of the pattern. It does not include any area that is within a building, under a canopy, beyond property lines, or obstructed by a sign or structure. Therefore, for a 15 ft. pole-mounted luminaire, the area will be described by a square that is 150 ft. (15 ft. x 10) on each side, or 22,500 ft^2 (150 ft. x 150 ft.), minus areas that are beyond the property line or other obstructions.

Question 2:

If two poles are separated by a distance greater than 10 times the mounting height, will all of the square footage between them be included in the general hardscape area?

Answer 2:

In most applications, such as parking lots, these square patterns will typically overlap, so the entire area of the parking lot between poles will typically be included in the general hardscape area when determining the lighting power budget. However, if the poles are so far apart that they exceed 10 times the mounting height of the luminaires on the poles, and the coverage squares do not overlap, then the nonilluminated areas between poles cannot be included in the general hardscape area.

Example 6-20: Calculating the Power Allowance for a Parking Lot

Question:

The parking lot illustrated below has two luminaires that are mounted at a height of 25 ft. What is the illuminated hardscape area and what is the general hardscape lighting power allowance? The lot is in Lighting Zone 3.

Figure 6-12: Image of Parking Lot

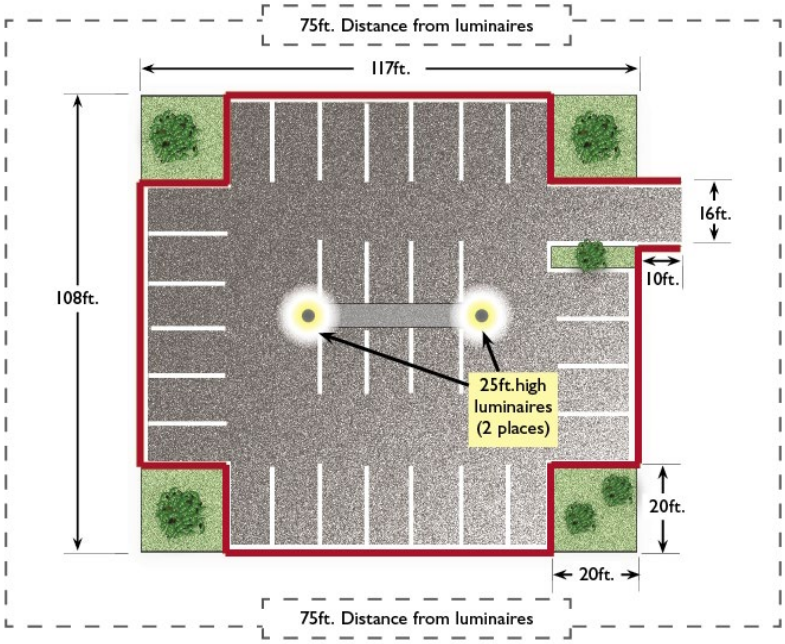


Image Source: California Energy Commission

Answer:

The poles are 40 ft. apart, and using the 10 times mounting height rule, the illuminated area can be as large as 250 ft. by 290 ft. The boundary of this illuminated area extends beyond the edges of the parking lot as well as the entrance driveway, so the entire paved area is considered illuminated. The landscaped island in middle and peninsula below the entrance driveway are less than 10 ft. wide, so they are included as part of the illuminated area, but not part of the hardscape perimeter. The landscaped cutouts (20 x 20 ft.) in the corners of the parking lot are bound by pavement on only two sides so they are not included. The total

paved area is 11,196 sq. ft. [(12,636 sq. ft. + 160 sq. ft. (driveway) – 1,600 sq. ft (cutouts)]. The perimeter of the hardscape is 470 ft. [(2 x 77 ft.) + (2 x 68 ft.) + (8 x 20 ft.) + (2 X10 ft.)].

Three allowances make up the general hardscape allowance: Area, Linear, and Initial. All allowances are based on Lighting Zone 3 and found in Table 140.7-A of the Energy Code.

The area wattage allowance is equal to 235.1 W.

The linear wattage allowance is equal to 94 W.

The initial wattage allowance (IWA) is 250 W for the entire site.

The sum of these three allowances gives a total wattage allowance for the site of 579.1 W.

The calculations are tabulated below:

- Initial: 250 W
- Area: 0.021 W/ft^2 x 11,196 ft^{2}ft = 235.1 W
- Perimeter: 0.2 W/LF x 470 ft = 94 W
- Total Power Allowance: 579.1 W

Example 6-21: General Hardscape Surface Question

Question:

Before the Energy Code, Title 24-2019 allowed a higher lighting power allowance for concrete hardscape surface. If I have a concrete plaza, what is the allowed lighting power allowance I should use for Title 24? The plaza is 115 ft. long and 105 ft. wide in a Lighting Zone 3 location.

Answer:

The distinction between different surface material types was removed in Title 24-. The lighting power allowance will be based on the Lighting Zone of the project location.

For a plaza located in Lighting Zone 3 the hardscape area must first be calculated. The general hardscape area is 115 ft. x 105 ft. or 12,075 sq. ft. The linear perimeter of this hardscape is the sum of the sides 115 ft. + 105 ft. + 115 ft. + 105 ft. or 440 ft.

Three allowances make up the total power allowance: Area, Linear, and Initial.

However, the initial wattage allowance applies one time to the entire site. It will be considered for usage for this plaza assuming that there is no associated parking lot or other general hardscape area. All allowances are based on the general hardscape Lighting Zone 3 application and can be found in Table 140.7-A of the Energy Code.

The initial wattage allowance is equal to 250 W.

The area wattage allowance is equal to 253.6 W.

The linear wattage allowance is equal to 88.0 W.

The sum of these allowances gives a total wattage allowance for the plaza of 591.6 W.

The calculation can also be tabulated as below.

- Initial: 250 W
- Area: 0.021 W/ft^2 x 12,075 ft^{2}ft = 253.6 W
- Perimeter: 0.2 W/LF x 615 ft = 88 W
- Total Power Allowance: 591.6 W

Example 6-22: Calculating the Power Allowance for a Roadway

Question:

A 300-ft.-long, 15-ft.-wide roadway leads through a wooded area to a hotel entrance in Lighting Zone 2, and the owner wants to light the roadway with luminaires mounted at a height of 20 ft. What is the allowed lighting power for this roadway with asphalt surface?

Answer:

The hardscape area for the roadway must first be calculated. If the entire roadway will be lit, then the 20 ft. poles will not be spaced more than 200 ft. apart and not more than 100 ft. from the ends of the roadway. (Lighted area is 10 times the pole height.) The hardscape area therefore is 15 ft. x 300 ft. or 4,500 sq. ft. The linear perimeter of this hardscape is the sum of the sides (not including the side that connects to the larger site) 300 ft. + 15 ft. + 300 ft. or 615 ft.

Three allowances make up the total power allowance: area, linear, and initial. However, the initial wattage allowance applies one time to the entire site. It is not considered for usage for this roadway piece which would only be one small part of the site. All allowances are based on Lighting Zone 2 and can be found in Table 6-4 (Table 140.7-A of the Energy Code).

The area wattage allowance is equal to 85.5 W.

The linear wattage allowance is equal to 92.3 W.

The sum of these allowances gives a total wattage allowance for the roadway of 177.8 W.

The calculation is tabulated below:

- Initial: 200 W
- Area: 0.019 W/ft^2 x 4,500 ft^{2}ft = 85.5 W
- Perimeter: 0.15 W/LF x 615 ft = 92.3 W
- Total Power Allowance: 177.8 W

Example 6-23: Flagpole Lighting

Question:

Is the lighting power for a flagpole exempt from the 2025 Energy Code?

Answer:

Yes. Lighting for a flagpole is considered lighting for a public monument. As described in the exceptions to Section 140.7(a), lighting power for public monuments is exempt from Section 140.7 of the 2025 Energy Code. Note that while the power is exempt, this lighting is still subject to the applicable control requirements of 130.2(c)1, and Section 130.2(c)2 of the 2025 Energy Code.

Example 6-24: Lighting for Private Streets

Question:

Does street lighting inside a gated community with private streets have to meet any lighting requirements?

Answer:

Yes. Lighting of private streets must meet the nonresidential outdoor lighting requirements. There are no exceptions to Section 140.7(a) for private streets. The lights must meet all applicable sections of the nonresidential lighting requirements. (The third exception to Section 140.7(a) is specific to public streets.)

Example 6-25: Lighting Control Requirements for Outdoor Lighting Exempt From Section 140.7(a)

Question:

For outdoor lighting, if lighting is excluded from the outdoor power limitations per the exceptions to Section 140.7(a), is that lighting also excluded from the outdoor lighting control requirements of Section 130.2?

Answer:

No. The only outdoor lighting control exception that aligns with the outdoor power exceptions is Exception 2 to Section 130.2(c)3. This means that if the lighting in question is exempt from the power limitations, it is also exempt from the motion sensing control requirements of Section 130.2(c)3. All other sections still apply.

Calculation of Allowed Lighting Power — Narrow Band Spectrum Light Source Applications

The Energy Code includes a lighting power provision for narrow band spectrum light source application to minimize the impact of electric light on local, active professional astronomy or nocturnal habitat of specific local fauna. The provision is in the format of lighting power multiplier as specified on the footnote of Table 140.7-A (footnote 3) which reads, "Footnote 3: Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna, shall be allowed a 2.0 lighting power allowance multiplier."

Example 6-26: Calculating Allowed Lighting Power for Narrow Band Spectrum Lighting

The lighting system for a lot in Lighting Zone 2 is being designed next to an active, professional astronomical observatory. The parking lot is 800 sq. ft. with a perimeter of 280 linear feet. All lighting within 10 miles of the observatory is required by a local ordinance to use a narrow band spectrum light source with a wavelength above 580 nm to be compatible within the telescopes' ability to filter out stray light while capturing most of the wavelengths of light from the night sky. Spectral power distributions of two amber light sources are shown in the two images in Figure 6-13: Spectral Distribution of Light Source Product A and B.

Figure 6-13: Spectral Distribution of Light Source Product A and B

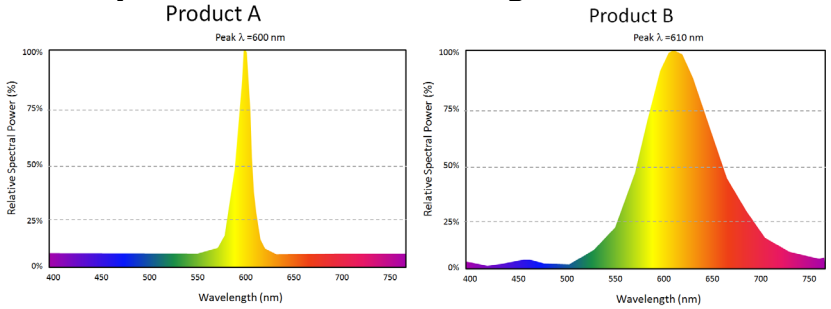


Image Source: Clanton & Associates

Question 1: Which of these products meet criteria for "narrow band spectrum" light sources?

Answer 1:

Narrow band spectrum light sources are those which have a spectral power distribution closely distributed around the wavelength of peak spectral power. There are no spectral power limitations on the wavelengths that are within 20 nm of the peak wavelength. As the spectrum diverges from the peak wavelength, the allowed relative spectral power declines rapidly.

Between 20 to 75 nm from peak wavelength, the spectral power shall be no greater than 50% of the peak spectral power.

Beyond 75 nm the spectral power shall be no greater than 10% of the peak spectral power. This distribution is reflected in the narrow ban spectrum criteria line centered around the peak wavelength in Figure 6- 14: Spectral Distribution with Narrow Band Criteria Superimposed. As shown in the figure, Product A is a narrow band spectrum light source as it fits within the spectral power criteria, whereas Product B does not comply as the spectral power exceeds the narrow band criteria.

Figure 6-14: Spectral Distribution With Narrow Band Criteria Superimposed

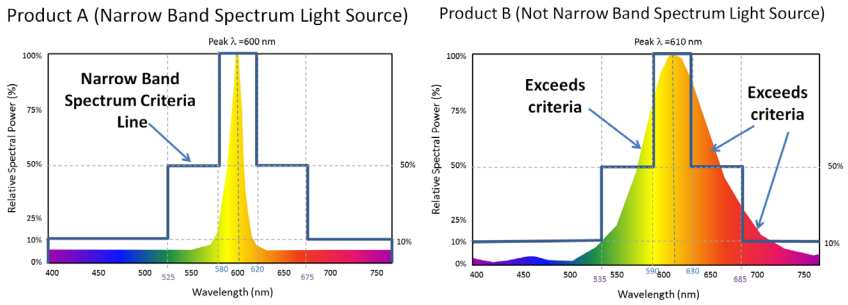


Image Source: Clanton & Associates

Question 2:

What is the allowed lighting power for this parking lot with and without the use of a narrow band spectrum light source?

Answer 2:

To claim the two times multiplier for narrow band spectrum light sources, as described in footnote 3 to Table 140.7-A, the project must comply with all three of the following criteria:

- The light source must have a narrow band spectrum (true for product A).
- The dominant peak wavelength must be greater than 580 nm (true for product A with a peak wavelength of 600 nm).
- The narrow band spectrum and dominant peak wavelength of the light source must be greater than 580 nm as mandated by local, state, federal agencies, to minimize the impact on local, active professional astronomy or on the nocturnal habitat of specific local fauna. (The credit is not available unless the ordinance specifically calls out a requirement for a narrow band spectrum.)

The allowed wattage without the narrow spectrum multiplier is calculated as follows:

Allowed Wattage = (Area Wattage Allowance) x (Area, sq. ft.) + (Linear Wattage Allowance) x (Perimeter Length, linear ft.) + (Initial Wattage Allowance)

The asphalt parking lot is 800 sq. ft. with a perimeter of 280 linear feet and is in Lighting Zone 2. From Table 140.7-A in the asphalt column of Lighting Zone 2, the power allowance factors are:

Area Wattage Allowance = 0.019 W/sq. ft., Linear Wattage Allowance = 0.15 W/lf, and Initial Wattage Allowance = 200 Watts.

Allowed Wattage = (0.019 W/sq. ft) x (800 sq. ft.) + (0.15 W/lf) x (280 lf) + (200 W) = 257.2 Watts

If the design makes use of narrow band light sources and meets all three criteria of footnote 3 to Table 140.7-A, the allowed wattage is multiplied by 2.

Narrow Band Allowed Wattage = Allowed Wattage x 2 = 257.2 W x 2 = 514.4 Watts.

Example 6-27: Low Blue Content Light Source Design

Question:

A lighting system is being designed for a similar parking lot as in Example 6-23 except that it is next to a wildlife refuge and all outdoor lighting near the refuge is required by a local ordinance to use low blue content light sources to minimize the lighting impact on nocturnal animals.

If the designer specifies a narrow band spectrum light source (such as Product A in Example 6-23), can the designer make use of the narrow band spectrum lighting power allowance multiplier in determining the lighting power allowance?

Answer:

To claim the two-times multiplier for narrow band spectrum light sources, as described in footnote 3 to Table 140.7-A, the project must comply with all three of the following criteria:

- The light source must have a narrow band spectrum.

- The dominant peak wavelength must be greater than 580 nm.
- The narrow band spectrum and dominant peak wavelength of the light source be greater than 580 nm, as mandated by local, state, federal agencies to minimize the impact on local, active professional astronomy or on the nocturnal habitat of specific local fauna (The credit is not available unless the ordinance specifically calls out a requirement for a narrow band spectrum.)

For this example, the narrow band spectrum credit is not available since the local ordinance called for low blue light content without specifying this had to be accomplished with narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm. As a result, the two-times multiplier for narrow band spectrum light sources cannot be used in calculating the lighting power allowance for this project.

Additional Lighting Power Allowances and Requirements by Application

Please refer to Chapter 6.5.3 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Further Discussion About Additional Lighting Power Allowance for Specific Applications

Please refer to Chapter 6.5.4 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Alterations and Additions for Outdoor Lighting

Please refer to Chapter 6.6 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Alterations – Increasing Connected Lighting Loads

Please refer to Chapter 6.6.1 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Alterations – 10 Percent or More of Existing Luminaires are Replaced

Please refer to Chapter 6.6.2 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Alterations – Half (50 Percent) or More of Existing Luminaires Are Replaced

Please refer to Chapter 6.6.3 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Alterations – Less Than 10 Percent of Existing Luminaires Are Replaced

Please refer to Chapter 6.6.4 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Additions – Mandatory Control Requirements and Lighting Power Requirements

Please refer to Chapter 6.6.5 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Additions and Alterations – More Examples

Please refer to Chapter 6.6.6 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Outdoor Lighting Compliance Documents and Acceptance Tests

Please refer to Chapter 6.7 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Overview

Please refer to Chapter 6.7.1 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Compliance Documentation and Numbering Scheme

Please refer to Chapter 6.7.2 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Certificate of Compliance Documents

Please refer to Chapter 6.7.3 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Certificate of Installation Documents

The certificate of installation is used primarily to declare that what was installed matches the plans and certificates of compliance. The certificate of installation is signed by a person with an approved license.

Even if the design has errors and has specified incorrect features and devices, the installer is responsible to meet all the applicable requirements that he or she installs.

A copy of the completed signed and dated installation certificate must be posted at the building site for review by the local enforcement agency in conjunction with requests for final inspection for the building. See Chapter 2 for more information about installation certificates.

Before a lighting control system, including an energy management control system (EMCS), can be recognized for compliance with the lighting control requirements in the Energy Code, the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components, or manufactured devices shall sign and submit an Installation Certificate (Section 130.4(b)1 and 2).

The nonresidential outdoor lighting certificate of installation includes the following:

- NRCI-LTO-E: Certificate of Installation, Outdoor Lighting

Certificate of Acceptance

Please refer to Chapter 6.7.5 of the *2022 Nonresidential and Multifamily Compliance Manual*.

Acceptance Testing

Please refer to Chapter 6.7.6 of the *2022 Nonresidential and Multifamily Compliance Manual*.