

BRIEF DESCRIPTION

Light pollution reduction is minimizing light trespass from the building and site and reducing sky-glow and glare. It increases night sky access, improves nighttime visibility, and reduces development impact on nocturnal environments.

Applications

Interior Lighting

- Fully control interior lighting through windows during non-office hours.

Exterior Lighting

- Use the minimum amount of lighting equipment
- Limit or eliminate all landscape lighting
- Carefully select lighting equipment and controls

Design Notes

Outdoor light maintenance

- Exterior luminaires should be periodically cleaned to maintain the design illuminance.
- Depending on the labor cost, group relamping may be beneficial and economically feasible.

Comfort and Safety

- Functionality and safety should be considered when lights are turned off or the overall illuminance levels are reduced.

Luminaire Selection and Location

- Two luminaires with lower lighting output and glare control perform better than a single high-output luminaire.
- Carefully select lighting equipment to avoid glare. Even full cutoff or semi-cutoff luminaires can produce excessive brightness and create glare.
- Pay attention to luminaires that are located near the property line to reduce light trespass.

Commission

- Commissioning is important to make sure lighting system is installed and operating properly.

Related Technologies

Occupancy Sensors

LED Parking Lot Lights

References/Useful Resources:

[1] LEED Reference Guide for Green Building Design and Construction (2009 Edition).

[2] Full Cutoff Lighting: The Benefits. LD+A. April 2001, P54. <http://www.iesna.org/PDF/FullCutoffLighting.pdf>

Energy Savings

Lighting Energy

- The lighting energy consumption can be reduced by turning off indoor lights and reducing outdoor lighting that does not provide function or enhance safety.
- More efficacious light sources, more efficient luminaires, and proper controls can further reduce the energy costs.

Operation Cost

- The total initial cost and operational costs for exterior lighting can be reduced by eliminating unnecessary luminaires. (The initial cost per luminaire may be higher because of the internal reflectors and shielding, more efficient lamps and ballasts, and/or controls.)

Social Benefits

Environmental Benefits

- Thoughtful designed outdoor lighting systems can minimize negative impacts on a site's nocturnal ecosystem.
- Reducing sky-glow can increase night sky visibility, which is important to night sky observation and military night training exercise.

Associated LEED Credits (NC 2009)¹

SS Credit 8: Light Pollution Reduction

- **Interior requirement (Option 1):** Use automatic controls on all non-emergency lighting (with a direct line of sight to any openings in the envelope) to have power reduced 50 percent or turned off during non-business hours.
- **Interior requirement (Option 2):** Shield devices, with less than 10 percent transmittance, should be installed over all exterior openings and programmed to close from 2300 to 0500 hours.
- **Exterior requirement:** Light areas only as required for safety and comfort. Lighting must be confined to the project site boundaries. Exterior lighting systems must meet ASHRAE 90.1-2007, Exterior Lighting Section.

¹ USGBC LEED Reference Guide for Green Building Design and Construction, 2009 Edition

Light Pollution Reduction

[PRODUCT AND ECONOMICS]

Product Images



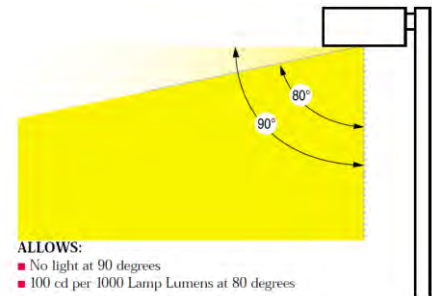
(Source: <http://www.intermatic.com/products/professional%20lighting/hid%20lighting/full%20cut-off%20wall%20packs/wlfc150hps.aspx>)

Components **Housing, Light subassembly, and Electrical systems subassembly**

Cost Range **\$200 – \$ 500** (Price varies in the lamp type. LED light is beyond this range).

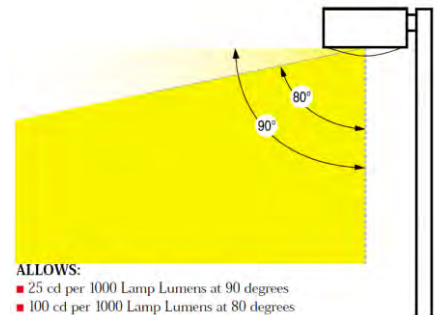
Product Types **Full Cutoff**

A luminaire light distribution where no light at an angle of 90 degrees above nadir, and 100 (10 percent) at a vertical angle of 80 degrees above nadir.



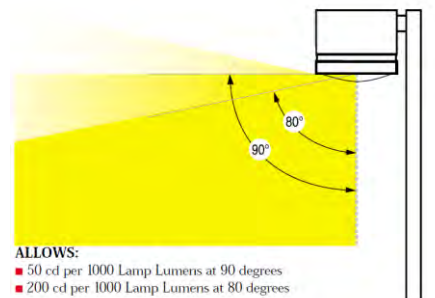
Cutoff

A luminaire light distribution where the candela per 1000 lamp lumens does not numerically exceed 25 (2.5 percent) at an angle of 90 degrees above nadir, and 100 (10 percent) at a vertical angle of 80 degrees above nadir.



Semi-cutoff

A luminaire light distribution where the candela per 1000 lamp lumens does not numerically exceed 50 (five percent) at an angle of 90 degrees above nadir, and 200 (20 percent) at a vertical angle of 80 degrees above nadir.



(Source: <http://www.iesna.org/PDF/FullCutoffLighting.pdf>)

Vendors

Stonco Lighting

<http://www.crescentlighting.com/stonco/index.asp>

Venture Lighting

<http://www.venturelighting.com/NAindex.html>

GE Area Lighting

<http://www.venturelighting.com/NAindex.html>

Warranty

Info

Lamp and ballast may have different warranty periods based on the rate life.

Code

Restrictions

Some local jurisdictions mandate the use of full cut-off light fixtures.

A. Interior Lighting

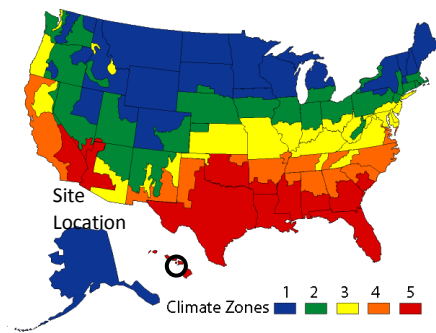
1. Develop a control plan for all non-emergency interior lighting fixtures being turned off or input power being reduced at least 50 percent following regular business hours. Control can be achieved through automatic timers, occupancy sensors, or lighting control panel.
2. Override capability should be included.
3. For projects that operate at night, automatically controlled or programmed shielding device with less than 10 percent transmittance should be installed at all exterior openings.

B. Exterior Lighting

1. Determine the zone classification for a project site using IESNA RP-33 and follow the requirements for that zone.
2. Calculate exterior lighting power density in accordance with ANSI/ASHRAE/IESNA90.1-2007, Section 9. Determine whether the site lighting power density exceeds the allowable densities for the project site.
3. Acquire manufacturer's photometric data for lamps used on the project site and perform light trespass analysis.
4. Develop a photometric site plan of parking areas to document horizontal and vertical foot candles at the site boundary and beyond.

Pohakuloa Training Area²

Hawaii



The view from Mauna Kea at night looking to the northwest. The yellow-orange glow over the towns comes from the low-pressure sodium streetlights. The photograph clearly shows that local light sources, located on the island of Hawaii, dominate over more distant lights from Maui and Honolulu. A blanket of cloud is seen covering the eastern half of the island. (Source: <http://www.starlight2007.net/pdf/proceedings/Wainscoat.pdf>)

Facility

- Pohakuloa Training Area (PTA) is located on the island of Hawaii. The training area is midway between Hilo, on the east coast and the Army landing site at Kawaihae Harbor. The area is the largest DOD installation in Hawaii.
- Additional lights were installed at training area in 2002. Many of these lights used poorly shielded high-pressure sodium lamps. These lights were the single largest source of light pollution for the two major observatories – Mauna Kea Observatory on the island of Hawaii and Haleakala Observatory on Maui. They also caused problems with army training using night-vision equipment.

Approach

- Many of the lights at the PTA have replaced by fully shielded low-pressure sodium lamps.

² Protection of Hawaii's Observatories from Light Pollution <http://www.starlight2007.net/pdf/proceedings/Wainscoat.pdf>