



DARK SKIES AND BRIGHT STARS BY DESIGN

By John Whitcraft, PE, CLD, LEED AP BD+C, President of [Whitcraft Engineering Solutions, Inc.](#)

Light pollution is at the forefront of any outdoor lighting design project I initiate. It is imperative that lighting design be initiated not only with a focus on innovation but also avoidance of light pollution. Before artificial light, humans depended on the moon and stars for night illumination. Currently, nature's night sky is littered with man-made light, blocking the once pristine view of the celestial world. The issue has compelled environmentalists and civic leaders to embrace dark-sky laws. ([The Washington Post](#)) As a result, regulations are benefiting the environment, economy, conservationists, and business leaders worldwide.¹

Light Pollution – Electrical Design is Critical

At [Mesa Verde National Park](#) in Colorado, the lighting system has been overhauled so that after the sun sets visitors can experience a naturally dark sky – once again teeming with bright stars, planets, and meteors. In doing so, the park became the world's 100th International [Dark Sky Park](#).

Conservationists at [Texas Parks and Wildlife Department](#) report that night skies are fading and natural darkness is disappearing. Consequently, an estimated 80% of Americans have never seen the Milky Way with approximately 300 billion stars of different sizes, intensities, and ages.

The culprit for fading natural darkness: the growing glare of artificial lights. The Texas Parks and Wildlife Department emphasizes that “poorly designed or installed outdoor lighting leads to light that is too bright, misdirected, or shining where it's not wanted.” Essentially, light pollution...

- Produces glare, limiting visibility at night;
- Creates light trespass (unwanted light);
- Wastes money for unnecessary lighting;
- Obscures views of the stars and planets; and
- Impacts the health of humans and animals.

California—Forefront of Dark Sky Lighting Requirements

The state of California designated certain desert communities

¹ International dark sky advocates and organizations include:
<https://www.darksky.org/light-pollution/light-pollution-solutions/>
<https://www.darksky.org/croatian-light-pollution-law/>
<https://www.darksky.org/light-pollution/>
<http://www.nationalgeographic.com/article/light-pollution/>

as early dark sky areas. Thus far, 34 such communities exist. ([Dark Sky](#))

Homeowners and businesses will want to know if their outdoor lighting needs to be dark-sky compliant. I recommend checking the city or county regulations. Although there may be no law for a specific region, building contractors and architects who care deeply about the natural ecosystem will probably install dark-sky lighting products anyway.

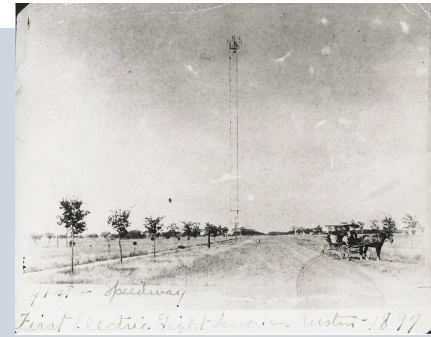
Bill Haddon, President of Friends of Taylor Observatory in Kelseyville, a Northern California community near Eureka states: “The distinction is not all about having the darkest skies; it's about what you're doing in the long term to preserve the dark skies you have... the most basic thing is to have the light pointing downward, not upward.” ([Lake County Bee](#))

Meeting the downward-pointing feature is easy to implement. Two of my architectural clients are considering the following:

- [D-Series LED Wall Luminaire](#) from Acuity Brands Lighting
 1. LEED requires strict outdoor light trespass control that until now has been nearly impossible to meet when the property line is adjacent to a parking lot.
 2. D-Series Extreme Cutoff Optics meet this criteria, providing a solution to gain a LEED point.
 3. D-series LED Luminaires solve challenging light trespass problems.
 4. Budget pricing is at \$1,600.00 each.
- [Midland 9-inch high dusk-to-dawn LED motion sensor light](#) from John Timberland Lighting
 1. Dusk-to-dawn operation and motion sensing features
 2. Downward light does not extend below a flat opening
 3. Available for less than \$100.00

Key features of a Dark Sky-Compliant Luminaire:

- Detects twilight and turns on after sunset, off after dawn.
- Motion sensors detect movement and adjust illumination level.
- Flat, downward light opening—lamp does not extend below the opening.



Moonlight Towers – Lighting in Austin, Circa 1890

The Moonlight Towers trigger nostalgia for many Austinites. First brought to Austin in 1894, these 165-foot towers assured residents of greater safety at night because they illuminated an area of several blocks. This type of tower with arc lighting was installed in large cities throughout the United States until outdoor lighting standards were introduced in the 1920s.

As of 2022 there are 17 remaining towers that are revered as city landmarks. The towers have also been inducted into the [National Register of Historic Places](#). In 1995, the towers were carefully restored with original components and then celebrated in a citywide festival. ([Documentary](#))

- Luminaire suits a rural setting without violating dark-sky rules or annoy neighbors.

The [International Dark Sky Association](#) has a list of [IDA approved lighting](#).

A Dark Sky Law

[In June 2021 Texas Senate Bill 1090 made it easier for communities to pursue International Dark Sky designations.](#)

The law encourages residents and businesses to turn off non-essential lights from 11PM to 6AM during specified bird migration periods. In August 2021, Austin and Fort Worth participated in the nationwide Lights Out Initiative in order to protect billions of birds as they migrate across the U.S. As of September, 2021, 15 sites are now designated as Dark Sky Places in Texas, seven of which are located between Fredericksburg and Austin.

Pittsburgh Fights Light Pollution

In late 2021, Pittsburgh, Pennsylvania, initiated an ordinance that made it the first major American city to adopt [lighting standards addressing light pollution](#). The law requires all new construction and renovations of city-owned buildings to comply with dark sky lighting principles, including replacing all city street lights with fixtures that feature timers and dimmers. Lights are turned on when needed and are shielded by directing to a specific area and no brighter than necessary.

The law applies only to city-owned property, which leaves 75% of buildings unaffected. One provision mandates that the city create a guide for private property owners and developers based on dark sky lighting standards. The city's major attractions, such as zoos and museums, will install compliant lighting in future renovations and capital projects.

Nationwide Trend: Brightening Landscapes with LED Lighting

Both businesses and homeowners in the U.S. will reduce light pollution and conserve energy if they use LED lights for their landscapes. LEDs last an average of 50,000 hours, making them more reliable than any other landscape lighting products available. ([Garden Light LED](#)) A compact fluorescent lamp lasts 8,000 hours and incandescent lamps last only 1,200 hours. Luminous efficacy is better: 81 lumens² per watt for LEDs, 62 lm/w for fluorescent and 14 lm/w for incandescent. Watts used per hour is better: LED uses 10 w/h, fluorescent uses 12 w/h and incandescent uses 60 w/h. (www.lightingever.com)

LEDs use solid-state technology to convert electricity into light. According to the [Dark Sky LED Guide](#), LEDs are small lamps that are part of a lighting power circuit. Unlike traditional incandescent bulbs, LEDs do not contain a filament and use less energy. LEDs are available in a wide range of color temperatures. Because of their improved quality and falling prices, LEDs are now replacing conventional high-intensity discharge (HID) lamps for outdoor lighting in many communities worldwide.

Benefits of LED Streetlights

The City of San Jose, CA, recently completed an LED Conversion Program, going from low-pressure sodium

² A lumen is the amount of light seen by the eye coming from a single source, the standard unit for the luminous flux of a light source.

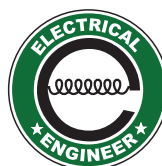
streetlights to LED streetlights – benefiting the city as follows:

- Reduced streetlight energy costs by 50%;
- Improved lighting quality and visibility and enhance street safety;
- Lowered maintenance costs by extending maintenance cycle for lamp replacement (LED fixture life is 4X that of sodium vapor lamps);
- Eliminated use of hazardous materials contained in sodium vapor lamps; and
- Preserved the night sky in late evening for astronomical research by Lick Observatory.

Automatic Sensors and Systems with LED Lighting

LED lighting design systems frequently come with an attached control sensor that identifies light and restrains illumination. These sensors can turn on the landscape lights based on the intensity of the natural light around them as twilight occurs. For that reason, the brightness of the LED landscape lighting can intensify as dusk occurs and decrease as dawn occurs.

Architects and lighting contractors can play a vital role in helping to preserve our night skies.



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Working in the Daylight Improves Construction Workers' Sleep Quality

According to a 2020 occupational survey, construction workers and others who perform physical labor outdoors in the daytime are likely to sleep soundly for seven to eight hours each night. Why? It all relates to circadian rhythms that respond to lightness and darkness.

Dorothy Chambers, who specializes in psychology and sleep-related issues comments, "Workers in the construction industry usually work daylight hours...[and] more likely to maintain a sleep schedule consistent with sunrise and sunset—making it easier for them to fall asleep and wake up at the same time every day." As a plus, daytime workers are often able to control their emotions and respond to difficult situations in a calm and healthy way because regular sleep balances stress hormones. ([Construction Executive](#))

Night workers can achieve similar stability with a regular sleep routine...using a darkened room for sleeping. Sleep experts suggest wearing sunglasses on the way home from work, decreasing light exposure, and going to bed soon after coming home from work.