



What's LED the way

Incandescent is out. We have burning questions about what's taking its place.

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Our long national “lightmare” is over. As of Aug. 1, new Department of Energy regulations effectively ban the sale of the traditional incandescent lightbulbs as well as halogen bulbs, leaving us with light-emitting diodes, or LEDs, as the main successor after ruling out fluorescent lighting. The regulations were first proposed during the Obama administration, nixed during the Trump administration, then revived during the Biden administration. So there’s been plenty of time to fight over whether this move is the silver bullet to save the environment, will bring about the end of society — or something in between.

LED has largely been crowned as the best of the bunch, due to its durability, brightness, flexibility of application and energy efficiency. But here we are now in 2023, complaining that LED lights are too bright and too blue. They’re keeping us up at night, messing with our circadian rhythms and causing light pollution in big cities.

At least that’s what National Park Service and National Optical-Infrared Astronomy Research Laboratory scientists concluded in reports published in 2021 and 2023, both cited in a recent Washington Post article headlined, “LED lights are meant to save energy. They’re creating glaring problems.”

LED technology revolutionized what is possible in lighting design. But “along with this powerful tool has come a wave of unintended consequences, such as excessive nighttime light pollution, dysregulation of human circadian rhythms, and headache-inducing glare,” said Brett Larson, architectural lighting designer for Leo A Daly. The experts on lighting at Greater Washington’s architecture and interior design firms say that these problems can be avoided, and there’s no reason to give up on LED just yet.



“Could it be that intuitive and automatic? Who knows?”

JASON DeCHAMBEAU, director of interiors at KCCT, suggesting that artificial intelligence may play a part in the future of lighting design. Imagine lighting systems that anticipate not just how to imitate natural sunlight based on the time of day, but also other situational lighting needs, based on what’s going on in a room. For example, an argument breaks out and the lighting automatically adjusts to a tone that reduces stress and adds calm to the room.

The bright side of dimming

When we first began the switch to LED lighting, it was mainly all bright white light — but today, even that aspect of LED is flexible.

“Energy efficiency improvements allow similar or greater levels of illuminance using less power, increased color variety both in actual hues and temperature of ‘white’ light, and when paired with the increasing color rendition or quality of light, yield a brilliant spectrum of rich color. And the progressively smaller size of the diodes allow for the light source to be very deliberately positioned within the design,” Jason deChambeau, director of interiors for KCCT, explained.

This allows LED to be integrated into any design and position, enabling “the application of lighting design with scalpel precision,” deChambeau said, including lighting as points, lines or whole planes in a room — it can really go anywhere. And today, we have even more control over the specifics, including the color and tone.

“LED technology can synchronize the lighting color temperature to shift with circadian rhythms. Allowing artificial light to mimic natural daylight and the movement of the sun yields a higher-performing workplace, as healthy spaces that are in sync with normal rhythms are desirable from a human health standpoint,” said deChambeau.

Lisa Bertolino, principal and vice president of specification sales for District Lighting Group, said the options in LED lighting just keep getting better, from full dimming scales to remote color control. Selecting luminaires — defined as a complete electrical light unit — from reputable manufacturers using high-quality LED chips and comfortable optics, Larson said, will result in less glare and reduce nighttime light pollution when used outdoors. Unified Glare Ratings (UGR) can help to choose the best luminaires for the job.



Bertolino



Larson



Carrera

THE BIG NUMBERS

30,000 to 50,000

Total hours in the lifespan range for an LED lightbulb

90%

Reduction in energy consumption in LED lights compared with incandescent bulbs

9.6%

Average annual increase in brightness of the night sky between 2011 and 2021

\$3B

Amount the Department of Energy expects U.S. consumers to save on energy bills with the ban on incandescent bulbs

SOURCES: Globe at Night, Fox Architects

Rhythm notion

The kind of lighting that is easiest on us physically and mentally is pretty much what you see out your window — bright, abundant light during the day when you're active, and then a gradual sunset, which helps us mentally wind down and rest at night.

"While this sounds simple in concept, an overwhelming majority of people are cooped up indoors during the daytime hours and experience a barrage of bright screens in the evening. This is a recipe for poor circadian regulation," Larson said.

This is why staring at a bright phone screen before bed can make it harder to get to sleep — it's mimicking that bright sunlight that tells you it's time to get up. It's hard to fight evolution.

Sometimes, that kind of bright workplace lighting is actually just what's needed.

"We can also shift that for 24/7 operations, like hospitals or mission-critical facilities — let's say defense or air traffic control — where they can begin to use the cooler light at 2 a.m. to keep people that are working the midnight shift awake and alert and attentive and still on point," deChambeau said. And in those hospitals, the cool, bright lighting might be used in the hallways for staff, but the patient rooms would use softer, warmer lights at night, so that they can rest, "because restfulness leads to recovery, rejuvenation," he said.

Of course, natural daylight is still the best option, so Larson said architectural designs should always aim to maximize that natural light where it's available, along with the right shading options. Interior finishes complement and enhance any lighting, adding to brightness.

"When designing a lighting system, 3D modeling utilizing ray-tracing technology is a powerful tool to accurately model the exact photometric distribution of lighting," Larson said.

Circadian LED lighting hasn't hit the mainstream. According to deChambeau, it's generally the designers who bring up the option, as most clients don't know to request it yet. One of his lighting contractors, Fisher Marantz Stone, shed some more, ahem, light on what you can expect if you request this feature.

Associate Principal Enrique García Carrera said these systems require two main components that differ from the standard system: different color LEDs that can change their color and light intensity throughout the day, and a programmable control system that can be set to adjust for the time of day and year, including daylight savings time. Though, that comes at a cost — he said the lights themselves may be 10% to 20% higher in price, and the control system can add a 25% to 40% price increase.