Next-Generation Lighting Strategies

IS | BUILDINGS

eHandbook

Contents

Click on title to see page

Contents

Next-Generation Lighting Design

Good lighting is about more than illuminating a space. It's about the comfort of a space with proper light levels and the absence of glare. It's about making tasks safer and easier to accomplish. And it's about perception—setting a mood with a light source that allows people to perceive rich color accurately.

Good lighting delivers on all of these tasks—and it does so while using energy efficiently.

This eHandbook is a resource for anyone who wants to know more about how to properly light a space. Gathering up-to-date information from industry experts, it includes insights on:

- Lighting quality metrics
- Lighting controls
- How to conduct a lighting upgrade
- Energy efficiency
- And more!

Each article in this handbook includes an excerpt from reports and white papers written by industry experts, along with a link to click for quick access to the full texts. It also features resources from our trusted manufacturing partners and a roundup of lighting products you can consider for your next upgrade.

We hope you find this eHandbook helpful in your quest for better, smarter illumination.

Robert Nieminen
Chief Content Director

Janelle Penny
Editor in Chief

CRI, Color Temperature and New Lighting Quality Metrics

By Janelle Penny

Lighting is about more than illumination. It impacts the room's mood, contributes to comfort and makes it possible to get an accurate look at the work you're doing there.

Energy-efficient light sources allow you to deliver that light wherever it's needed without overspending.

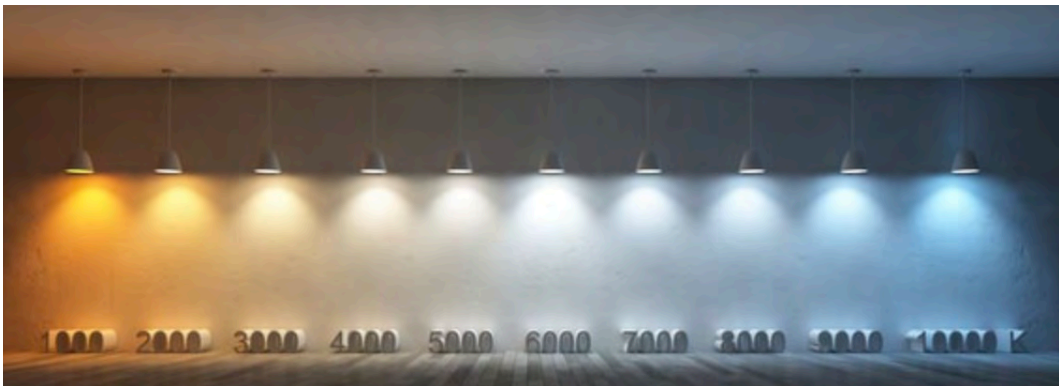
Today's commercial LED lighting is highly efficient, but two equally efficient light sources could have radically different effects on the quality of lighting in a space.

Because efficiency isn't the whole story, it's crucial to compare lighting quality before you purchase. The primary tools used to describe and quantify quality of light are color temperature and the Color Rendering Index (CRI).

Here's why you need to compare both quality indicators to determine your best LED lighting solution.

HOW IS LIGHTING QUALITY MEASURED?

Both color temperature and the Color Rendering Index have been around for many years and describe different aspects of light quality.



Color temperatures for LED lighting in Kelvin (K)

COLOR TEMPERATURE

Measured in degrees of Kelvin (K), color temperature quantifies the color of white light. Lower color temperatures appear visually "warm" and have more of a red-yellow tint—think of a classic incandescent light bulb, which typically has a color temperature around 3000K.

Mid-range color temperatures between 3500 to 4100K have a more neutral and true white appearance because the color wavelengths of the light are more balanced. At the other end of the scale are high color temperatures above 4100K, which have a cool, blue-tinged look.

COLOR RENDERING INDEX

CRI measures a light source's ability to display the color of objects relative to the color rendering abilities of a specific light source, such as a phase of daylight or a black body radiator (an object that absorbs all electromagnetic radiation regardless of its frequency or angle).

A CRI rating above 80 is considered generally accurate at rendering, though some LED lighting manufacturers have products with CRIs in the 90s.

NEW LIGHTING QUALITY METRICS

The existing color rating systems have shortcomings, explained John Yriberri, North American market leader at Modular Lighting Instruments. That's why the Illuminating Engineering Society (IES) developed a more comprehensive replacement for the CRI, called the IES-TM-30-15.

"Because TM-30-15 is somewhat new and requires a more in-depth understanding of color, CRI continues to be used throughout the industry and will likely continue for some time to come," said Yriberri. "Since CRI only addresses eight color samples—none of which are saturated in nature—for many applications using LED sources, it is important to also evaluate the R9 value."

R9 is not one of the test color samples used to calculate CRI, so it's important to evaluate it in addition to the CRI value. It represents how accurately a light source will reproduce deep red, which is more difficult to create with LEDs than colors with shorter wavelengths like blue, green, yellow and orange.

Consider asking manufacturers about R9 data so you can make sure your commercial LED lighting can render the red tones in your facility accurately.

Many of these metrics require specialty lab equipment to measure, so it's crucial that you know manufacturers are relying on certified labs to collect and report these measurements, Yriberri said.

WHAT CRI AND COLOR TEMPERATURE DO I NEED?

Finding the right commercial LED lighting for your project requires an in-depth knowledge of what you need to accomplish in each application. Different spaces need different color temperatures and Color Rendering Index ratings.

"CRI and application requirements are very closely linked," noted Yriberri. "For example, the light quality required in the utility room of a hotel is different than what should be used in the restaurant or bar.

For a utility room, the primary objectives might be brightness for doing detailed tasks and energy savings, whereas the primary objectives for a restaurant/bar might be color rendition and 'comfortable' light, both in intensity and color."

A CRI of at least 80 would be fine for the utility area in this example, Yriberri explained, but the restaurant and bar area would need a CRI of 90 with an R9 (deep red content) of 50, because the color rendition of people and objects is so much more important in the restaurant.

"Like CRI, color temperature is also very dependent on the application," Yriberri said. "The utility room would benefit from a cooler light source, especially if detailed tasks will be performed, so minimum 3500K should be selected. For the restaurant or bar, the idea would be to create a cozy environment, so a warmer light source like 2700K should be selected."

He added, "Color temperature can influence not only how a space looks, but also a person's subconscious behavior. In the bar/restaurant example, using a light source that is too cool can make the place look sterile, which translates to more like a hospital-type setting. Subconsciously, this can make a person feel uneasy and more likely to leave the space, even though the person may not directly realize that the lighting is creating this unpleasant environment."

OTHER IMPORTANT LIGHT QUALITY CONSIDERATIONS

Yriberri recommends weighing each application to see if you could benefit from dimming controls. The utility room example may not have much need for dimming, but a hospitality space like a bar or restaurant may use several different color temperatures and dimming levels throughout their open hours.

"The dimming should be free of flicker and stroboscopic effects," said Yriberri. "In regard to dimming and flicker, a responsible manufacturer will have a dimmer compatibility list or chart for each product. This chart requires testing to ensure performance and is highly recommended to match the dimming system and the luminaire to ensure that the performance is going to meet expectations."

Today's commercial LED lighting marketplace can leave you spoiled for choice, but examining the tasks that will be performed in each space will help you narrow down the right color temperature, CRI and other metrics to include in your specification.

READ MORE

Study Says Lighting Controls Boost LED Efficiency by 47 Percent

By Sarah Kloepple

LED technology has made a huge impact on the world of lighting over the past decade. But today, the residential and commercial markets face different fates.

Energy savings opportunities in the residential arena will soon be "largely exhausted," according to a recent study by Energy Futures Group (EFG). But in the commercial sector, potential savings remain significant.

The study notes that adding networked lighting controls to LED installations boosts energy savings by an average of 47% beyond savings from LEDs alone.

"The technology has been a lot quicker to adapt to the lamps in the residential market. With commercial, there's just so many different applications, it's been a little slower to transition to LED technology," said Tina Halfpenny, executive director of the DesignLights Consortium (DLC), the Massachusetts-based national non-profit that sets efficiency standards for commercial lighting products that guide establishment of incentives by public utilities across the US.

Photo: Panelists at the "Lighting and the Smart Building" session at the DLC's 2019 Annual Stakeholder Meeting in St. Louis. (L-R): Ron Zimmer, President and CEO of the Continental Automated Buildings Association; Michael Skurla, Director of Digital Strategy for BitBox USA; LumiFi Founder and Creative/Product Director Beatrice Witzgall; Darlene Pope, Global Head of Smart Buildings and Digital Workplace at WeWork; and DLC Executive Director Christina Halfpenny. Credit: DesignLights Consortium

Halfpenny adds that the savings potential continues to grow in the commercial space, particularly with interior lighting. Even if you've done a lighting retrofit in the past, first-generation lighting retrofits could be eligible for incentives and support if you transition to state-of-the-art lighting now.

"Efficiency gains have been pretty significant," Halfpenny said.

NETWORKED LIGHTING CONTROLS

LEDs are one of the fastest ways to reduce energy consumed by buildings. According to EFG's study, because of more stringent building codes, LEDs might soon be considered baseline for new construction projects.

According to the study, the most significant savings in the commercial sector exist within:

- Linear LED lamps and fixtures
- Parking area/garage products

The study notes that adding networked lighting controls to LED installations boosts energy savings by an average of 47% beyond savings from LEDs alone.

"One thing DLC is focused on is trying to really educate and communicate the benefits of networked lighting controls," Halfpenny said.

"It's still a recent technology. It still has its bumps and warts, but potential is really significant—not only to bring energy savings, but also streamlined management of a building's lighting system. There isn't quite so much change required when you need to change your lights or building layout if you've gone with a networked system," she continued.

These systems offer better personal comfort for tenants, as they can control lighting quality and intensity. Facilities managers can also use them as smart building features to observe areas that are unoccupied during certain times and, as a result, turn down HVAC and lights.

"All of these things really increase the flexibility and versatility of the lighting system," Halfpenny explained.

She added, "A lighting retrofit can seem really straightforward and cost-effective, particularly if there are utility incentive rebates associated with it. But if you can bring in controls, whether they be integrated controls or a networked system, you're just going to be able to gain so much more out of it."

WHAT'S NEXT

As lighting systems become more sophisticated, one of the goals of the DLC is to try and bring an easy-to-access resource to facilities managers and lighting decision-makers. Its Qualified Products List is used by utilities nationwide to find verified, quality LED products.

"There are so many solution-based lighting systems out there now," Halfpenny said. "It can be confusing. We're trying to make that more straightforward and accessible with the tools we have, so that facilities managers and building owners can figure out what it is that they need."

Based on this EFG study, the DLC hopes to drive up its baseline on efficacy. With LEDs and networked lighting controls, commercial facilities managers and utility programs "have the potential to capture significant lighting savings."

If a lighting retrofit is in your near future, consider how networked lighting controls and LED can transform your energy load.

READ MORE

Evaluation of Advanced Lighting Control Systems in a Working Office Environment

I. EXECUTIVE SUMMARY

This report presents an evaluation of a set of advanced lighting control systems and their potential application to U.S. General Services Administration (GSA) facilities.

A. DEMONSTRATION DESIGN

This evaluation project measured and analyzed five different light-emitting diode (LED) lighting systems with advanced controls. The evaluations were conducted within a large office-type GSA building in Fort Worth, Texas, which was originally lighted with 4-foot, T8 fluorescent lighting fixtures with electronic ballasts. Five separate zones were identified within the building as individual test beds for each lighting system.[1]

Energy was measured separately on an individual lighting circuit level for each of the zones. Measurements were taken for a minimum of 2 weeks during each project period and included the following:

- pre-retrofit baseline conditions (existing fluorescent lighting)
- initial LED lighting installation (no controls)
- light-level-tuned conditions
- occupancy sensing enabled
- daylighting enabled

Building occupants were surveyed before and after the project to provide information about how they perceived the new lighting and how well it served their needs. Light-level data also were measured in selected open spaces in each evaluation zone pre- and post-project to provide insight into changes in light levels that help drive energy savings and contribute to occupancy satisfaction.

This project was not intended to compare specifically one product with another. The project was designed to evaluate the capabilities of these advanced technologies and highlight their positive and negative attributes.

B. EVALUATION RESULTS

Energy Savings. Energy savings for lighting systems come from reduced maximum lighting power density [LPD] (watts /ft^2) and control of the lighting (on/off/dimming). The measured data for this project show a significant reduction in LPD, which varies between zones but is significant in all of

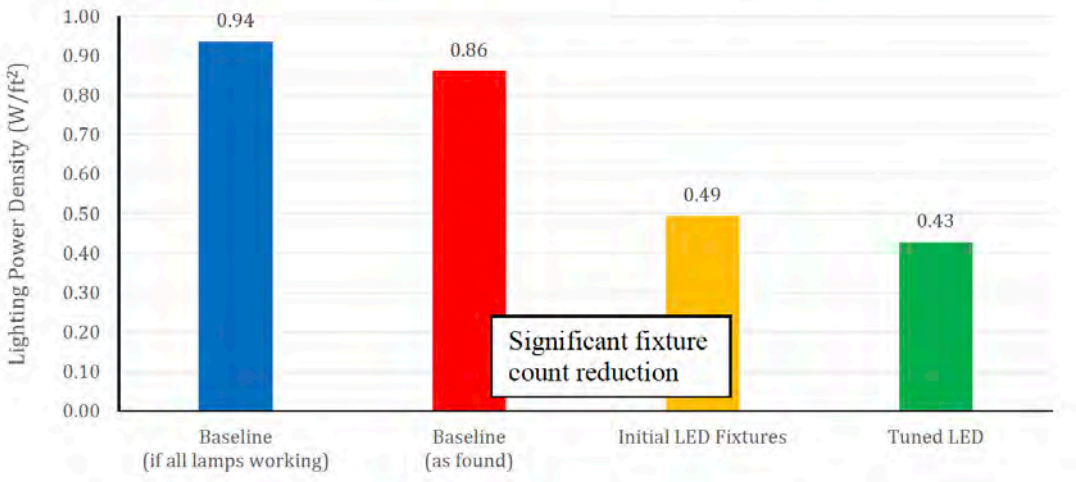
[1] Zone 7 included office (mezzanine) and non-office (hallway) spaces. Because the non-office space type has different use characteristics than the office space, it was removed from the results presented in the main section of the report. Data for the hallway portion of Zone 7 is presented in Appendix A.

them. These reductions are primarily attributable to a significant reduction in light levels, which were based primarily on a large reduction in the number of fixtures installed to replace the previous lighting fixtures (approximately 30%, from 1,212 down to 847).

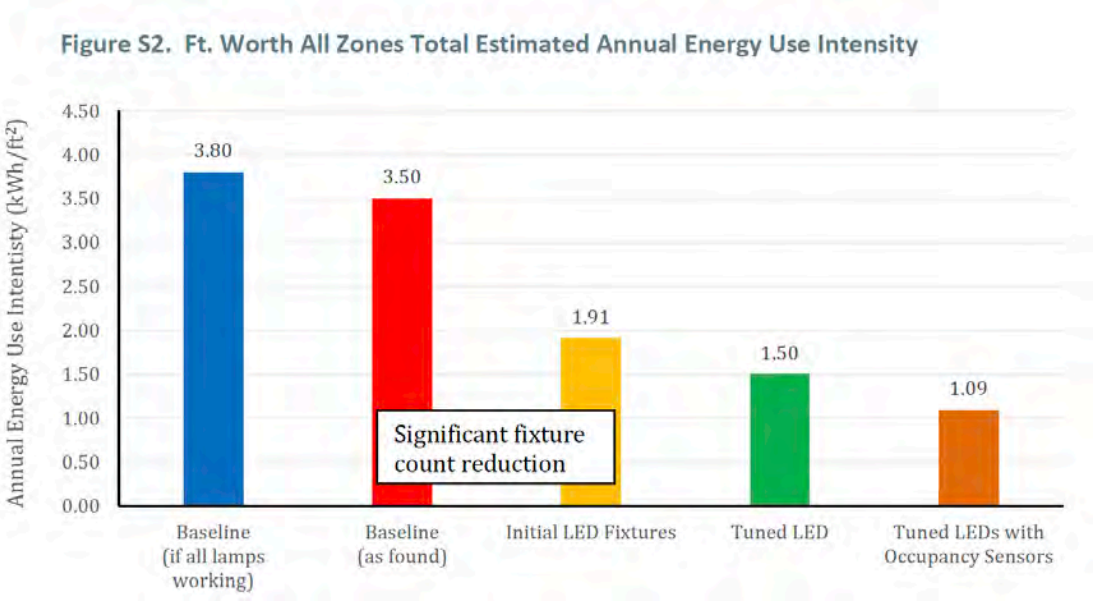
Figure S1 shows the total site LPD as it existed before the project and as the new LED lighting system was installed and tuned to final light levels. The "baseline" bars represent the maximum lighting power of the pre-retrofit fluorescent lighting system if all lights were working and as found (some lights were burned out or removed) and without any active controls. The after LED fixture and after tuning bars represent the reduction in maximum lighting power with new LED fixtures and light levels adjusted to occupant needs. The LPD reduction across all zones going from fluorescent to LED lighting is 53% (0.86 W/ft^2 to 0.41 W/ft^2) of the original lighting power.

This energy reduction is caused by more than one effect and was accompanied by a significant (32%) average reduction in light levels supported by a large reduction in fixtures as part of the retrofit, which could reasonably account for the first 32% of the 52% overall savings.

Figure S1. Ft. Worth All Zone Weighted Average Lighting Power Density



The addition of control effects provides a complete picture of actual energy savings. The addition of advanced controls provided additional savings but with less variation between zones. The total estimated annual energy use per square foot for all zones combined is shown in Figure S2.



For all office zones combined, the total annual energy use intensity (EUI) savings of 2.41 kWh/ft² (3.50–1.09) represents a 69% overall reduction in lighting energy use. Note that the final EUI of 1.09 kWh/ft² is well below the reported GSA average of 3.25 and the national office average of 2.7.[2] These significant savings are attributable to several factors:

- 45% of the savings resulted from a combination of improved lighting efficiency (LED) and significant light-level reductions (up to 76%) supported in part by a reduction in total light fixtures.
- Another 12% of the savings resulted from using the light-level tuning capability of these advanced systems. (This tuning is typically an initial setting of light levels to meet occupant needs and is a feature of advanced lighting systems that can be applied later to accommodate changes in occupancy or task needs. This is different from active occupant-activated dimming during the workday that may be an option with some systems).
- The remaining 12% of savings resulted from the networked occupancy sensor and limited daylighting control.

Table S1 provides the EUI values of each of the zones with different lighting systems and controls employed in the space. Table S1 also shows the EUI savings per zone as well as the total of the entire space monitored.

[2] Energy Information Agency Commercial Building Energy Consumption Survey 2012. https://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/e6.php

Table S1. Ft. Worth Energy Use Intensity by Zone

	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7 (Mezzanine)	Total
Fluorescent Baseline	3.49	2.32	3.97	3.00	5.33	3.50
LED Only	2.86	0.98	1.99	1.95	1.66	1.91
Savings	[0.63]	[1.34]	[1.98]	[1.05]	[3.67]	[1.59]
LED+Tuning EUI	2.34	0.84	1.03	1.71	1.55	1.50
LED+Tuning Savings compared to fluorescent baseline	[1.15]	[1.84]	[2.94]	[1.29]	[3.78]	[2.00]
LED+Tuning+Occ. Sensors EUI	1.79	0.54	0.83	1.03	1.25	1.09
LED+Tuning+Occ. Sensor Savings compared to fluorescent baseline	[1.70]	[1.78]	[3.14]	[1.97]	[4.08]	[2.41]

Total lighting energy savings in this evaluation project are significantly driven by reduced light levels. Light-level tuning savings that are part of reduced light levels are typically driven by occupant preferences or task needs, which can significantly vary from office to office. Occupancy sensor savings vary by occupant activity, sensor arrangement, and sensor settings and these also can vary significantly.

The total 69% facility savings found in this evaluation varied from zone to zone with a low of 49% to a high of 79% for office areas, as shown in Table S2. Some of the difference in savings between zones can be related to differences in each lighting/control system and its application. However, significant differences are also attributable to the initial characteristics of the site and final application of controls and light levels. An important observation of these results is the variability in savings, which may not always be easily identified in each application.

Table S2. Ft. Worth Estimated Annual Percentage Savings by Zone

	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7 (Mezzanine)	Total	Typical
Fixture Count Change	[16%]	[47%]	[47%]	[8%]		[30%]	---
New LED fixture install only	18%	58%	50%	35%	69%	45%	---
Tuning Savings	[15%]	[6%]	[24%]	[8%]	[2%]	[12%]	[36%]
LED fixture + tuning	33%	64%	74%	43%	71%	57%	---
Occupancy Controls Savings	[16%]	[13%]	[5%]	[23%]	[6%]	[12%]	[24%]
Total Savings from Lighting Controls	[31%]	[19%]	[29%]	[31%]	[8%]	[24%]	---
LED fixture + tuning + occupancy controls (total)	49%	77%	79%	66%	77%	69%	---

The savings from lighting controls in this project are consistent with energy savings from lighting controls on other projects. A meta-analysis of energy savings from lighting controls includes typical values of 24% occupancy sensors; 28% daylight harvesting; 31% personal tuning; 36% institutional tuning; and 38% multiple control strategies.[3] The tuning value for this site and the meta-analysis differs because of other reductions in equipment (and subsequent illuminance values) occurred before the tuning controls were employed.

Illuminance Values Changes. Section 6.2.2, Lighting Quantity, of GSA PBS-P100 states for Tier 1 that the lighting quality meets the Illuminating Engineering Society (IES) 10th Edition Handbook. Chapter 32, Lighting for Offices, of the IES Lighting Handbook 10th Edition has an illuminance table with a range of values based on occupant age and task. The IES recommends 300 lux [28 fc] for visual display terminal (IES uses the VDT abbreviation referring to computer screens). GSA actively looks to provide appropriate light levels for office tasks. Horizontal illuminance values after the retrofit in all areas also ended up being below typical lighted commercial office environments. Table S3 provides the baseline and tuned LED horizontal illuminance values which ranges between 7 and 35 fc post retrofit. These illuminance values may be practical for applications at this and similar sites, but may not be applicable for all typical office environments and this will affect the potential energy savings compared to those found in this project.

Table S3. Ft. Worth Change in Illuminance

	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7 (Mezzanine)
Baseline (fc)	35.7	30.1	37.7	45.6	Not measured
Tuned LED (fc)	35.4	7.3	24.7	27.0	Not measured
Light Level Change	1%	76%	35%	41%	Not measured

Occupant Satisfaction. The results of surveys of occupants before and after the project show that acceptance of the new LED lighting systems varied some but appeared to be generally lower than for the original system. Given the small sample sizes, it is not clear that the actual differences are numerically instructive. It also is known that human response to change tends to be cautious at first and, therefore, it is not clear whether future responses will be more positive. Regardless, the acceptance percentages after the retrofit are still generally above a reasonable 70% acceptance threshold set by GSA.

Cost Effectiveness as Installed at the Site. The calculated cost effectiveness of this particular project is not encouraging: simple payback periods (SPB) ranged from 26 to 48 years. Note that these cost effectiveness results are specific to this particular site. They should not be used to determine the potential cost effectiveness or applicability of advanced LED-based lighting controls to other sites or projects. The results at this site are related to characteristics that may be found at some, but not all, typical GSA applications. These include:

[3] Williams et al, Lighting Controls in Commercial Buildings. Leukos. January 2012. Savings vary on baseline conditions, building configuration, occupant profiles, and even specific rooms within a given building.

- A very low electricity rate of $0.07/kWh compared to a typical National average rate of $0.11/kWh.
- Typical fixture installation cost of approximately $168/fixture.[4] Actual costs at this evaluation site are likely higher than typical because of the need for much relocation of fixtures to accommodate lighting needs.
- Occupancy sensor controls already existing in most spaces in all zones prior to the project, which reduced the amount of savings found after installing the new advanced system.
- Extremely limited daylight capability (only a few windows in one zone). This site evaluation provides data in support of installations without daylight availability. Other evaluations will provide better information for sites with significant daylight capability.

Potential for Project Cost Effectiveness by Varying Site Conditions. The results of this study provide useful data on the potential savings available from advanced LED-based lighting systems. These data can be used to help determine the cost effectiveness of this technology at any office-type site based on selected site-specific characteristics. As a result of this project evaluation a method has been developed that allows sites to determine possible project cost effectiveness. The results of this evaluation also help confirm a set of useful recommendations for prioritizing the application of this technology across GSA facilities. In general, sites or projects with the following attributes are prime candidates for lighting projects and should be considered first:

- Higher than needed existing light levels
- No existing automatic controls
- High electricity rates (energy and demand charges)
- Utility rebates available to help offset first costs.

The attributes of advanced control systems can provide additional energy savings over more typical stand-alone lighting controls, but these may not be cost effective unless the appropriate opportunities exist.

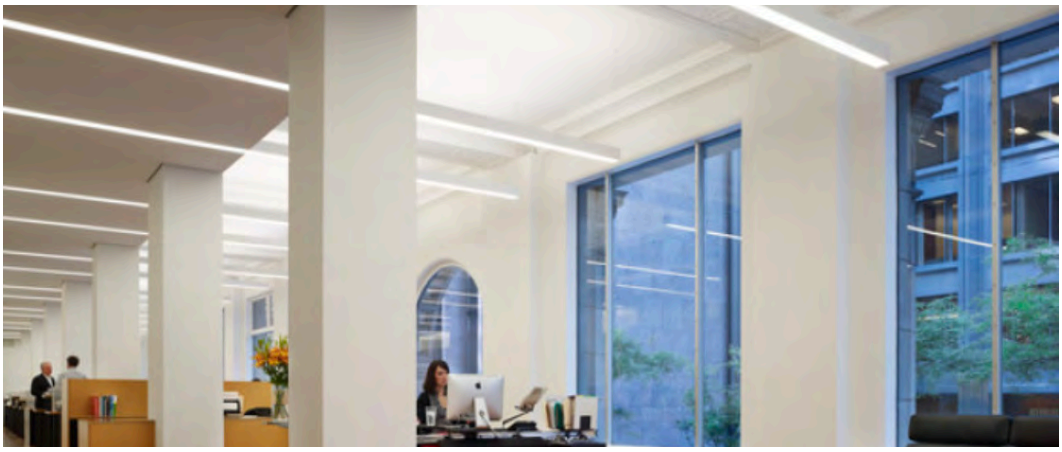
Table S4. Performance Objectives – Advanced Lighting Controls Systems Evaluation

Quantitative Objectives	Metrics & Data Requirement	Success Criteria	M&V Results
Reduce energy usage	Real-time energy metering pre- and post-installation plus comparison with lighting requirements	Energy savings compared to standard expected GSA facility lighting	**Criteria Met.** Savings of an average 63% were achieved with the installation of this control technology
Reduce costs	Cost comparison of current technology and	Favorable energy savings based on SPB and savings-to-	**Criteria Not Met.** Although savings are significant, SPB

[4] Costs used in this analysis are based on estimates developed for GSA by an architect and engineering firm for typical GSA projects. Actual costs at this site were higher but are known to include additional project work costs so they are not considered typical.

Quantitative Objectives	Metrics & Data Requirement	Success Criteria	M&V Results
	advanced lighting control replacement	investment ratio (SIR) over standard lighting controls	and SIR based on estimated typical costs are very high
Easy installation	Installer survey	No issues identified that would raise safety or excessive labor concerns	**Criteria Mostly Met.** Installers found installation time/effort mostly similar to or easier than traditional lighting. Some issues with fit and extra time for separate components
Reduce maintenance	Installer survey plus operator survey plus equipment specifications	Lower calculated maintenance needs compared to the fluorescent system	**Criteria Potentially Met.** Operations indicate systems functioning well and LED technology historically requires less lamp maintenance.
Occupant satisfaction/comfort	Occupant Survey	70% of occupants expressing no issues with the system that would cause dissatisfaction in terms of light levels or function of the system in performance of tasks	**Criteria Just Met.** 77% of occupants found the new lighting acceptable for office tasks and 70% indicated the light was comfortable.

READ MORE



What You Need to Know About Human-Centric Lighting

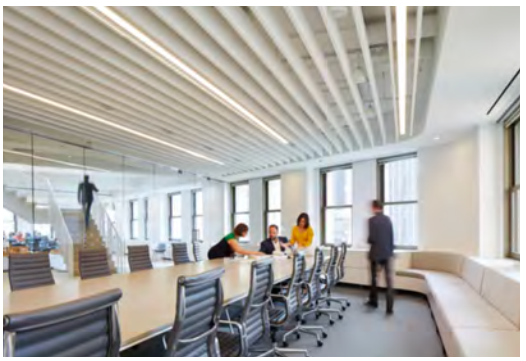
By Sarah Kloepple

It's easy to understand how certain lighting might strain our eyes, increase our body temperature or bring a certain level of ambiance to a space. But as studies continue to show that we spend a significant portion of our lives indoors, it's important to understand how lighting can less obviously affect our wellbeing—and, therefore, the wellbeing of your occupants.

Any lighting expert will surely know of the buzz surrounding human-centric lighting (HCL). Some consider it a fairly new technology, as much is still unknown or unproven about how it really affects human health.

Although more research on its human impacts is still needed, according to BIS Research, the global market for the technology is expected to hit $3.91 billion by 2024.

As HCL becomes more streamlined, consider what the technology is, what it's believed to do to human health, how you can incorporate it and what you should consider before investing in the technology.



Tunable lighting - Perkins+Will office. Photo credit: Perkins+Will

WHAT IS HUMAN-CENTRIC LIGHTING?

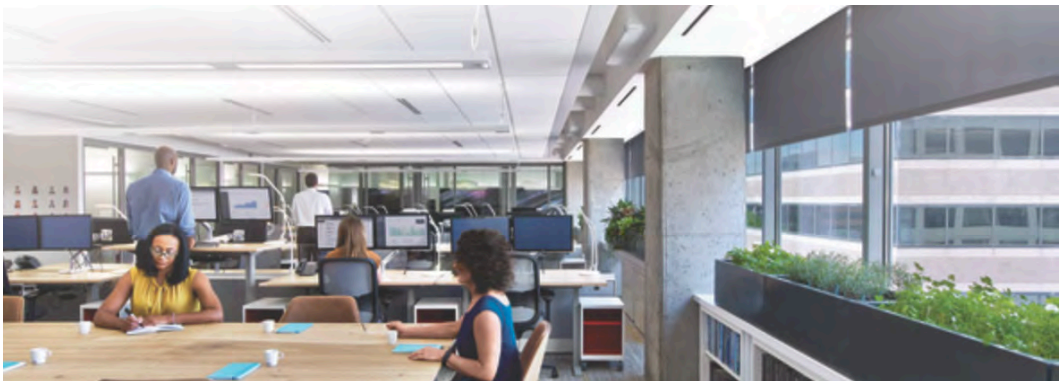
That can be complicated to answer, as there are many definitions of HCL out there. Brent Protzman, director of building sciences and standards development for lighting control company Lutron, said some definitions only focus on circadian rhythm (your body's sleep/wake cycle), while others only focus on daylighting or the user experience.

A comprehensive definition of this technology needs to encompass all of these things, he noted.

LightFlex LED with tunable white lighting in a classroom. Credit: Sunoptics

"What we want to make clear is human-centric lighting needs to take in all aspects of how the lighting system affects people—that could be how it affects their wellbeing, productivity or mood," Protzman explained.

"It could be how it affects their ability to complete tasks, take ownership of their environment or their connection to the outdoors. Without considering all of that and lighting quality too, you're not considering all things the occupant is trying to do in the space," he continued.



Daytime office using lighting and natural lighting from big windows. Credit: © Eric Laignel of Perkins+Will

Human-centric lighting, then, is a holistic approach that should include all aspects of how lighting affects occupant wellbeing, productivity and comfort in the built environment.

"Really there's no better system to provide lighting in the space than daylight," said Pete Shannin, vice president and general manager of Sunoptics, which focuses on skylights and daylighting systems. "But unfortunately, there are times during the day when there's not enough daylight in the space to provide the light levels the user needs. They essentially have to turn the lights on to be able to do that."

HOW HCL AFFECTS HUMAN HEALTH

So, what do we know about how HCL affects human health? Studies have shown that poor lighting can have negative health effects—especially on our circadian rhythm.

Also known as our sleep/wake cycle, circadian rhythm is a 24-hour internal clock that "is running in the background of your brain and cycles between sleepiness and alertness at regular intervals," according to the National Sleep Foundation.

Circadian rhythm responds to lightness and darkness. Too much or too little exposure to certain types of light can then affect:

- Behavior
- How well we sleep at night
- Overall personal health

Paul Fritz, senior project engineer at SMP Engineering, said HCL has shown promising results in healthcare settings, such as senior care facilities.

"What some of the initial studies are showing is that if you have the ability to adjust both the intensity of the light and the color temperature during certain portions of the day, what they're finding is the residents and patients have fewer symptoms. They have fewer trips and falls. They're less agitated."

INCORPORATING HCL TECHNOLOGY

Despite HCL's increasing popularity, some lighting companies are hesitant to market their products as able to improve human health or productivity, citing the lack of research.

"We're of the opinion right now that the science is too early to be able to make that conclusion from a features or benefits perspective," said Jared Morello, director of product management and marketing at Legrand. "There are a few important milestones we're looking for in order to be able to start making those claims."

Photo: Emergent-Bio-Solutions office.
Credit: Legrand

But when discussing HCL technology, one new piece of tech that often comes up is tunable white lighting, which allows for the end user to adjust the intensity and color temperature of the light to mimic natural light.

Scientists agree:

Blue-white light is best for exposure during the day.

Amber light is best for exposure closer to the evening, as it's meant to mimic the setting sun.

"What you tend to see in research is that you want that blue-white wavelength early in the morning," Shannin explained. "During the day, that's what's going to help support circadian rhythm. Natural light on its own does

that better than any light source. During parts of the day you want to color shift. Later in the day, daylight is no longer available. At that point, you don't want cool white light. You want to shift from cool to warm, so you don't suppress melatonin production."

Tunable white lighting allows you to achieve this equilibrium – and its smart controls are a major part of that. As lighting controls become more sophisticated and automated, lighting systems have the power to become more human-centric.

That could mean something as simple as installing a wireless keypad that an end user can easily use to change the light level or shade position. Protzman said shade automation can help occupants avoid direct glare, heat gain and thermal discomfort "without having to get up from their desk and go pull a chain throughout the day."

Replacing your skylight with a glare-free uniform light source is another way to incorporate human-centric lighting.Replacing your skylight with a glare-free uniform light source is another way to incorporate HCL.

"There's a misconception in the marketplace that if I just cut a hole in the roof and I bring light into the space, that's naturally good, uniform light. That's not the case," said Shannin. "You're going to get daylight, but it's not going to be well controlled."

IS IT TIME TO REPLACE YOUR SKYLIGHT?

Skylights allow more natural light to beam down on your building and its occupants—but older ones can be detrimental to your safety and comfort.

"It shouldn't be something you overlook if you're a facilities manager," said Shannin. "It might be a great way of improving the light quality and saving energy—just by updating your skylight."

Grohe said to pay attention to these signs that indicate it's time to replace your skylight.

1. Leaks

Have you noticed leaks that appear to be coming from the unit?

"Usually, skylights aren't leaking—they're just condensating," said Grohe. "That condensation has nowhere to go, so it falls inside the building." New skylight technology can incorporate built-in condensation channels and ways of reducing the amount of moisture that forms. "What does form, they have channels to move that water from the frame. … You don't get it inside the building."

2. Discoloration

Skylights can degrade to the point where their color changes, usually to a shade of yellow or light brown. This is commonly caused by corrosion of the sealant. New technology like polycarbonate skylights are stronger and more UV-resistant than traditional materials.

3. Cracks

Older skylights with cracks are not only unsafe for your occupants, but for your staff or contractors as well. Cracks create a fall hazard for anybody who's working on a rooftop.

WHAT TO CONSIDER

Before you decide to invest in this technology, lighting experts say to consider these points when it comes to installing or retrofitting lighting systems that are described as human-centric.

1. Select a system that's flexible.

"The biggest thing for facilities managers is having to live with their investment," said Morello. "From a tenant perspective, [HCL] is going to give an additional level of flexibility. That's the biggest thing. You can set up a schedule in the background so color will change automatically. … That takes a little bit of the workload off the end user."

2. Select a system with a wide range of capabilities.

"When retrofitting smart lighting, facilities managers should look at future-proofing the building by selecting a system that is scalable and allows for simple configuration," said Mark D'Ambrosio, senior project engineer for Focal Point LLC.

Added Protzman, "As we learn more, you can adapt those systems you have and those capabilities there in place. So you don't have to wait until next time, 15-20 years down the road, when you're planning on doing a major retrofit. You've already prepared yourself for that."

3. Make sure controls are easy to use.

"Adding features that aren't easy and intuitive for the end user could actually be a detriment," said Protzman. "You can imagine many people have gone in to buildings or rooms they've never been in before and said, 'I don't know what to do.' It's a mess sometimes. It's really important that user experience is considered as part of the design."

Use of tunable lighting at Pinnacle Office. Credit: Legrand

4. Don't forget about daylight.

Take advantage of all of the daylight you can get.

LEARNING CURVE

There's still much we don't know about human-centric lighting and how it affects our health. However, Protzman said lighting engineers have always been lighting buildings and designing for the occupants.

"It's not that we've been doing things differently," he explained. "The good thing we have today that we didn't have before is the technology is getting better and better. We're adding more capabilities, and that allows us continue to do human-centric lighting in ways we haven't been able to before."

But when it comes to light and wellbeing, he said, "we're still learning."

READ MORE

Modern interior of a hotel lobby. | Credit: krsmanovic

How to Manage your First Lighting Retrofit

By Valerie Dennis Craven

A lot goes into planning a lighting retrofit, and if it's your first time undertaking the project, it can be hard to know where to start. Knowing the right priorities to focus on, people to work with and solutions can help make the project a success.

When beginning a lighting retrofit, you need to know your goals and requirements of the project, said Frank Agraz, business development manager at OSRAM SYLVANIA. Common goals and requirements include cost restraints, energy savings and lighting requirements.

DETERMINE LIGHTING RETROFIT PROJECT GOALS

"People need to understand the corporate goals, at both the local and office level, of who the audience is and the expectations of the retrofit," Agraz said. If the goals of corporate and the needs of the retrofit don't line up, challenge them.

"Are the right metrics being evaluated?" he asked. "Include total cost of ownership if that's needed to show value and wasn't being included."

Consider who's evaluating the bids. Is someone from procurement who doesn't know about lighting deciding what retrofit to use? Or is someone with industry knowledge making the final decision? The final decision maker should understand the total cost of ownership and what goes into lighting.

Exterior of an office building Credit: Dima Moroz

It's important to understand the cost of waiting, Agraz stresses. If getting the bids and deciding who to use and when to start takes several months, that's several months of energy savings that's being lost. Going with a lighting partner that could have moved the project along sooner might be more cost-efficient in the long run.

PARTNER WITH A LIGHTING PRACTITIONER

Once you have figured out your goals and requirements, choose a lighting partner that maximizes your goals.

"Find a lighting practitioner who knows the whole industry and solution, not just certain brands," Agraz suggested. Be sure they help you get the result that's right for you and aren't receiving an incentive to do a project that fits their goals and needs.

When searching for a lighting partner, look for someone with credentials that show they are an expert who has passed an exam and has continuing education. Examples of lighting credentials include LC, CLMC, NCQLPO and NALMCO.

FIND THE RIGHT SOLUTIONS

There are three main lighting retrofit options – luminaires, kits and TLEDs. Of those, "you need to define what's the 'best' or 'right' solution for you," Agraz said, noting there are benefits and drawbacks to each option.

Luminaires

- New fixture or redesign
- Existing system is in poor condition
- Optics and thermal management are critical

Kits

- Reuse the housing already there
- Minimum disruption
- Balance of cost and performance

- Existing luminaire is in good condition and location

TLED (tubular LED)

- Lowest first cost
- Lowest total cost of ownership isn't a priority

Once you've narrowed down the type of lighting retrofit, you can look at specific lighting products. When looking at a manufacturer's product to determine if it's right for your project, consider its:

- History
- Capabilities
- Recalls
- Failure rates
- Lessons learned
- Warranties
- Support

Don't overlook the potential hidden costs and value, including incentives, waste removal and rebates.

Evaluate whether you have the right amount and solution in a given space, and ensure it's maximized for efficiency. This could mean reducing the lighting load with a higher efficacy solution or the amount a light is on or dimmed, as well as designing solutions for the appropriate level so as not to overlight a space.

For more information on undergoing a lighting retrofit, Agraz suggests the Illuminating Engineering Society for information including lighting handbooks, design and practical information.

READ MORE

Things to Consider Before Starting a Lighting Upgrade

By Janelle Penny

The most important thing your lighting projects can accomplish is putting the right lighting in the right place. That task is harder than it sounds, however. Lighting technologies are evolving constantly, and the changing market can make it difficult to know which new features could actually benefit your building and its occupants.

Facilities professionals don't have to become lighting engineers on top of their many other tasks, but knowing your options helps ensure the right lighting is specified for every space in your building. Learn how to differentiate your upgrade options.

WHY REEVALUATE YOUR LIGHTING?

If your lighting is only doing one job—illumination—then it's not working as hard for you as it could be. You may want to reevaluate whether your lighting is doing enough for you if it's been several years since your last upgrade.

Specific lighting needs are usually dictated by a few factors, according to Bill Lally, president and founder of tech integration firm Mode:Green:

- Energy code (specifically, the maximum allowable watts per square foot)
- New lighting types that give owners and occupants more control, such as tunable white lighting that allows users to change the color temperature

- Available daylight
- Advances in lighting controls

"The energy code is one of the big drivers [of lighting upgrades], and wellness is theother driver we're seeing," Lally explained."There are things like Bluetooth beaconing where you're tagging a system to your phone or Apple watch so that a conference room comes alive when it knows you walked in. We're seeing the same concept for tuning lights – in a conference space or ballroom, you could have the lighting during the day be a productive bluish-white, and then at night when you've got a wedding in there, you push a button and it shifts into a more relaxed environment. [New controls] are changing the way design and space requirements are being used."

LED luminaires and control packages are constantly evolving, making it hard to determine the best time to upgrade. Investments are at risk of becoming outdated shortly after they're installed. Shannon Glover, a senior lighting designer for global design and consulting firm Stantec, recommends focusing on the appearance and functionality of new lighting rather than getting the next best thing. Are the qualities of your newest lighting package capable of serving you until your next scheduled upgrade?

You can ensure the answer to that question is yes by basing your specs on fixture quality, color rendering and temperature that are appropriate for the space they're in, and control flexibility.

"In some sense you start with the maximum potential requirement in terms of lumens, color temperature, dimming and color tuning, etc. the space might need," said Tanuj Mohan, founder, chief technology officer and chief product officer of Enlighted. "Then, with a five-year horizon, you optimize for cost. Steve Jobs said that 'everyone needs to learn how to code—it teaches you how to think.' Upgrades are a bit like that. The easiest and most powerful upgrades come from a digital platform that can leverage software upgrades to do new things with the existing hardware."

3 TOP LIGHTING TRENDS

These three trends seem to be gaining popularity in commercial lighting projects. Could one of them work for your next upgrade?

Intelligent Lamps

"Intelligence itself is moving away from large dimming panels and infrastructure and into the bulb itself," explained Lally. "It's changing the way designers are designing systems. The controls typically work off Wi-Fi or Zigbee as opposed to having it be wired into control points. The bulb has various functions of color and zoning, so in an application like an office, it gives the lighting infinite flexibility as far as how you want to zone that space instead of having to rewire the whole area."

Tunable White

Now that it's possible to adjust the same luminaire between warm and cool white, end users are discovering new ways to employ these technologies. Imagine how warmer or cooler white light could benefit people in different types of spaces. For example, an office might use cooler light to stimulate productivity in workspaces but employ warmer light in the cafeteria.

"We're looking at using it in classrooms where students are making projects with fabric or paint. You can adjust the light to adjust how you perceive the objects in the space," said Glover.

Dim to Warm

A similar technology, dim to warm, transitions the lighting toward a warmer color temperature as you dim it, Lally added.

"You can control the intensity and brightness separately from the color," Lally said of dim to warm bulbs. "It gives a whole new flexibility for designing in these spaces. You can have a light at 100% brightness that's still an orangey candlelight."

WHEN TO PROPOSE LIGHTING UPGRADES

LED luminaires won't burn out for a long time, but there are a few reasons you might decide to replace them before they've failed.

- The LEDs are old enough that they've dropped below 70% of their original light output.
- The existing lighting has a deficiency, like poor color rendering or inadequate light output.
- You're about to renovate anyway and want to address an existing problem with the lighting infrastructure.
- You're moving into a new space or expanding into an adjacent one, and the lighting setup in your new square footage doesn't meet your needs.
- You don't have enough control and want to switch to a system with individually addressable devices in each fixture.

Whatever your reason, Glover recommended speaking with a lighting consultant so you can make sure your new system will be flexible enough to meet your needs now and in the future. Have an idea of what issues you have with the current lighting system and what problems you need to solve.

"If it's an established facility, we'll tour or visit their current building to see what they have and ask what do you like, what do you not like, what's working and what isn't, and develop a palette of options," said Glover. "We're big proponents of physical mockups where we obtain sample luminaires and display them for the owner to review. They can see, touch and feel, and I think it makes a huge difference."

CASE IN POINT: DALLAS HOLOCAUST AND HUMAN RIGHTS MUSEUM

Museum lighting can cover the full spectrum of lighting requirements, from bright retail lighting in the gift shop to dramatic installations in theaters or exhibit spaces. Glover shared insights from designing the permanent gallery of the new Dallas Holocaust and Human Rights Museum.

Lighting can deliver cues and wayfinding, not just illumination. The museum experience starts with an orientation in a theater and continues up three flights of stairs with lighting and short films cuing visitors to continue upward.

"The logistics of it were really tricky, just from the idea of how we'd move people through a three-story stairwell," Glover said. "It took a ton of work and effort between the museum staff, media designers and lighting team to make sure that the light fixtures have enough light so that people could see to climb the stairs, but not so much that it washed out the videos. They change color too, so you see the film on the landing and then the lights change color to let you know it's time to go."

The third floor of the Dallas Holocaust and Human Rights Museum features the Pivot to America exhibition. Bright white light makes the red, white and blue Texas Upstander Wall pop, and illuminates 12 kiosks on the process of repairing injustice for different groups of people. Credit: Paul Go Images

Don't be afraid to use lighting to set a mood or create an effect. Museums do this masterfully, but the same concept could apply to other building types—think of a relaxing social space in an office building or a hospital chapel. The owners of the Dallas Holocaust and Human Rights Museum were "adamant that they did not want it to be a depressing, morose place," Glover explained.

Make sure the lighting engineers work with other disciplines. For this project, the lighting engineers couldn't afford to work in silos—they needed to coordinate closely with AV specialists and others, especially on the staircase exhibit.

Lighting plays a key role in illustrating the Shoah floor. The exhibit starts out with a calm white palette, then progresses into dark brown as visitors approach the portion of the exhibit on the concentration camps. A stark chandelier pairs bare lightbulbs with personal items Jews might have taken with them to the camps. The exhibit then transitions back into lighter tones as the visitors move toward the liberation of the camps. The museum's stakeholders wanted to create an environment that was powerful and educational, but not theatrical. Credit: Paul Go Images

Master the learning curve. A new facility or an extensive upgrade might leave you with a new control suite that your team isn't familiar with. Make sure the implementation team goes over how the lighting control system works with your staff—not just how to create a schedule, but how it works in concert with other systems. The lighting system manufacturer can also provide valuable training.

HOW TO UPGRADE YOUR LIGHTING SYSTEM

The goal of your lighting upgrade should be to deliver light that's comfortable for people in the space as efficiently as possible. Consider these five keys for lighting upgrades when you're weighing your options.

1. Choose the right infrastructure.

You don't want your system to be outdated as soon as you buy it. Mohan recommended investing in a lighting control system with software that's easy to update.

"Make sure the system has headroom and is all digital," Mohan suggested. "The CPU or MCU [the brain of the system] should be upgradeable over-the-air and have spare cycles and memory to do more in the future, not cost optimized to do just lighting or HVAC control. The communication (network), both within the device and to a gateway, should have spare bandwidth to communicate more information in the future if needed. The sensors (motion, light, temperature, etc.) should be reconfigurable with software to provide more or different data if needed in the future. For example, not a photodiode that's good only for daylight harvesting, but a full spectrum digital light sensor capable of identifying color temperatures and differentiating sunlight."

2. Check compatibility.

All of the pieces of your LED lighting system should be able to work together. You don't necessarily have to lock yourself into a single manufacturer, but buying components from too many different channels can introduce complications into your project.

"LEDs work as a system. There's the lighting element itself, which is the equivalent of the bulb, and then there's a driver behind that controlling the dimmer and the electric flow to the circuit," Lally explained. "All of those pieces need to match. There are also several ways LEDs can dim—for example, there's electronic low voltage dimmers and 0-10V dimmers. Make sure all of the pieces, from the dimmer to the driver to the lamp itself, are all compatible and work together."

A lack of coordination on this front can doom a project before it can get off the ground, Lally adds. Poorly organized lighting specifications are one of the most common project mistakes he sees in the field.

"We'll see that a system's calling for a specific spec on a bulb or driver. Throughout the process, because of budgets, it gets value-engineered, and at that point they choose something that looks like the same thing but isn't compatible," Lally noted. "There have been projects where we rebought the lamps two to three times because the first one didn't work and they went for the less expensive option. The second one should work, but didn't. All of that can be avoided if it's tested up front. Literally mock up the system on a bench with the dimmer, driver and bulb and run it through a few tests of dimming it and making sure it's not going to flash or flicker."

3. Understand where not to cut corners.

Some aspects of lighting upgrades just weren't meant to be value-engineered. Don't let your project fall victim to the ways in which lighting changes a room for the worse.

"One mistake I've seen recently with regard to a school is that downward pressure on the lighting fixture budget leads to decisions that are not in the client's best interest," Glover said. "The less expensive light fixtures are sometimes made with less quality control. They might have a thinner lens that doesn't diffuse the light as well, so you end up with spotty light patterns on the floor or ceiling. It might not hang straight, which can be aggravating. Lighting is often first to get targeted for cuts when it comes down to budget consideration. We try to talk clients through those decisions or save in other areas."

4. Embrace automation.

New lighting control suites allow a "set it and forget it" mentality to a much greater extent than their predecessors after the initial commissioning is done, Lally said. Features like color temperature that emulates daylight throughout the day can be automated so that you don't have to keep returning to your dashboard to make sure you're mixing in the right proportions of yellow and blue.

"Some systems are set by longitude and latitude of the building so that once it's set, the system will run itself and emulate the exterior light based on the time of day. It knows the date and time, and it knows the sunrise and sunset shifts based on astrological clock data," Lally explained. "The sunrise/sunset aspect has been implemented for quite a while, but the emulation of color temperature is new. The systems have become very flexible and user-friendly as far as how to achieve those different settings throughout the day."

Automation benefits individual users too, Lally added. A recent project at the 1 Hotel Brooklyn Bridge Park combines lighting scenes and automated climate control in guest rooms, both of which deliver energy data to the management team. Guests control the lighting scenes from a single keypad. A "Good Night" button next to the bed shuts off every light in the room with one button.

5. Choose a customer-friendly manufacturer.

One thing that's often overlooked in discussions about lighting controls is how to choose a manufacturer. Glover suggested "specifying a manufacturer who has excellent customer service, because nothing goes perfectly 100% of the time." When something inevitably goes haywire, you'll want a company that will truly partner with you to get your space back up and running as soon as possible.

The lighting team working on the Dallas Holocaust Museum recently ran into some minor function issues with the museum's lighting controls, but Glover reports that "the manufacturer was involved immediately. They're troubleshooting and giving diagnostics from the computer system to figure out what's going on so the museum doesn't have to worry about it," she added.

Lighting upgrade options are likely to keep multiplying, but knowing when and how to kick off your next project will help you start your project right. There's no single right answer to which lighting types you should use in any given space—it's about delivering results.

READ MORE

Best Practice Options for LED Lighting in Multifamily Offer Illumination without Negative Impacts

By Sean Denniston

LED lighting had some of its earliest and broadest successes in exterior lighting applications. The substantially better energy performance of LED light sources resulted in significant energy savings in exterior applications, especially considering the long operating hours and large areas that often characterized many exterior lighting installations. The long service life and resulting lowered maintenance costs only contributed more cost savings to the decision to use LED lighting. And the better color rendering LED offered over the High Pressure Sodium (HPS) lamps that dominated exterior lighting applications was a non-energy benefit that just made another strong selling point.

However, the early and rapid adoption of exterior LED lighting did have some bumps along the way. LED lighting was sometimes criticized as being too bright, too white (or even too blue), too harsh, etc. LED lighting and its relatively high color temperature intensified general concerns about the impact of nighttime lighting on human circadian rhythms and sleep patterns. Concerns were significant enough that in 2016, the American Medical Association (AMA) Council on Science and Public Health issued a warning about the potential negative health impacts of LED site lighting. These issues are especially pertinent for multifamily projects since site lighting is in such close proximity to bedrooms.

The good news is that there are some readily available best practice approaches that designers can pursue to mitigate the negative impacts:

Luminaire Shielding. Luminaire shielding is a well-established solution to limit the encroachment of light into peripheral areas. Light shields can be installed on luminaires to block illumination in one direction. Luminaires with a higher cut-off angle that direct light in a more downward direction can also help reduce light trespass. LEDs are inherently a directional light source, so they are well suited to creating luminaires with higher cut-off angles, which are also a good approach to reducing light pollution in general. (For more on the issue of light pollution, see the International Dark-Sky Association's resources at www.darksky.org.)

Color Temperature. Concerns about the impact of site lighting on human circadian rhythms and sleep patterns can also be addressed through specifying LED lighting with a lower color temperature. The AMA recommends that site lighting should have a color temperature no higher than 3000K.

Color temperatures of white light varying 2700K, 3000K, 3500K, and 4100K from left to right. Image courtesy of the Energy and Technology Center, Sacramento Municipal Utility District.

Color temperature is the way that the color of light is graded. Color temperature is measured in degrees Kelvin (K.) Lower numbers like those in the 2000s denote a "warmer" light that is more orange and yellow, a light more like traditional incandescent lamps. Higher numbers denote "cooler" temperatures that tend more toward blue. Most fluorescent lamps used in interiors are in the 3000s, with some "daylight" models in the 4000s or even 5000s. White LEDs are actually blue LEDs with special coatings, and they can have very high color temperatures. Many of the LED site lighting products available have a color temperature of 5000K, well within the range of what is considered "daylight" products.

Specifying lights with higher color temperatures exacerbates their negative impact on sleep. Lighting with a higher color temperature resembles sunlight more, and therefore its potential to disrupt the circadian rhythm and sleep is greater. Some studies indicate that white LEDs have five times the circadian rhythms disruptive capacity as High-Pressure Sodium (HPS) lamps.[1] A very simple way to address this issue is to specify lighting with a lower color temperature and a "warmer" light quality. The options for lighting are not as broad for exterior lighting as interior, but many LED site lighting products are available in 3000K configurations, right in line with the recommendation of the AMA.

Light Levels. The light from LEDs is different from previous technologies like Higher Pressure Sodium and Mercury Vapor. As such, the adoption of LED lighting presents the opportunity to rethink light levels completely. The peculiar light characteristics of HPS lamps means that the design rules of

Bright, widely spaced luminaires in this parking garage create glare and deep shadows that can actually decrease safety. (NBI's Advanced Lighting Guidelines)

thumb developed for them do not translate well to other light sources, especially LEDs. To address this issue in new lighting designs, it is important to design for the light characteristics of LED sources avoiding old guidelines that were developed over years for the particular light characteristics of HPS. Designs with LED lighting should be calculated from the target foot-candle.

Site lighting brightness should actually be reconsidered in general. Higher light levels are often desired or demanded for safety reasons. However if care is not taken, increases in luminaire brightness can have a negative impact on safety due to contrast and glare. Bright light sources in the landscape cause the pupil to contract and let less light into the eye. These overlit pools of light deepen shadows in the landscape, potentially hiding hazards and dangers. Making the fixtures brighter does not address this problem, and may in fact exacerbate it. The human eye does not adapt well or quickly to large light level changes, so if the person moves from a well-lit area of the site to a less well-lit area, it can take 10-60 minutes for their eyes to fully adapt. The best strategy for security lighting is lower light levels that are more even across the traveled site area, to avoid the creation of high-contrast dark zones.

Controls. Even highly efficient light sources like LEDs can benefit from good control strategies. The energy code requires controls that turn site lighting off during daylight hours, but there are opportunities to turn site lighting off or down during nighttime hours as well. Most sites see a period with little to no activity each night. During these hours, site lighting can be turned down and landscape lighting can be completely turned off to increase site lighting efficiency. LED light sources are very well-suited to dimming, making step down strategies very feasible. These strategies can also reduce complaints in multifamily projects from occupants about bright site lighting at night without sacrificing security and safety.

READ MORE

Upgrading from Fluorescent to LED Troffers: **Avoiding Excessive Brightness**

INTRODUCTION

When replacing fluorescent troffers with light-emitting diodes (LEDs) it is important to specify the new troffers effectively. In some cases, the new lighting system can create a space that is too bright, resulting in wasted energy and complaints from occupants.

WHY DOES THIS HAPPEN?

The Lighting Research Center (LRC) at Rensselaer Polytechnic Institute examined potential mechanisms for why some LED replacement troffers make a space too bright. New LED troffers may produce more luminous flux (lumens) than needed for the space.

New LED troffers may also make a space appear brighter for the following reasons:

- When changing from a louvered fluorescent troffer to a typical lensed or "volumetric" LED troffer, more light may shine outward toward the walls; brighter walls can increase the perceived brightness of a space, even if the total luminous flux is the same.
- When changing from a low-CCT source (e.g. 3000K) to a high-CCT source (e.g. 5000K), the room will appear brighter, even if the total luminous flux is the same.

SPECIFYING NEW LED TROFFERS

This guide details four steps that will provide adequate brightness without wasting energy, when specifying new LED troffers.

Step 1: Determine target illuminance

If occupants are satisfied with the current light levels, the best way to determine target illuminance is to use a calibrated illuminance meter on several unobstructed desktops (after dark or with the blinds closed). Note whether the illuminance meter uses units of lux vs. footcandles. Calculate average horizontal illuminances on typical desktops.

Note the height of typical desktops and height of existing troffers. Use scaled plan drawings to note locations of the existing troffers.

If occupants find the existing lighting to be too dark or too bright, adjust target illuminance accordingly.

If field measurements are not possible, use the IES Lighting Handbook to determine recommended light levels for that type of space.

Step 2: Identify troffer light output needed to achieve target illuminance

Once you determine the target illuminance level (in lux or footcandles) on the workplane, and luminaire locations, perform a photometric simulation to identify the light output (in lumens) needed from the troffer. In order to perform a photometric simulation, here are three options you may want to consider:

- Request the assistance of a lighting manufacturer's application engineers.
- Use free online tools provided by lighting manufacturers (several examples are listed in the Resources section of this guide).
- Hire a lighting specifier or lighting engineer.

All light sources experience reduced light output over time; to account for eventual reductions in light output, increase target light output by at least 10%. For example, if target illuminance can be achieved with a 3000-lumen troffer, select a product with 3300 to 3500 lumen output.

Step 3: Identify troffer with lowest power that provides target light output

LED troffer data sheets will include the lumen output for various configurations including different wattages. Select the product that meets the target lumen output with the lowest power demand.

Step 4: Consider controls

If possible, provide dimming controls that either the occupant can access (such as a slider on a wall switch) or the building manager can access (called "high-end" trim). However, such strategies may not allow financial incentives or rebates for all of the energy savings because the full connected load is not reduced. To maximize incentives, it would be better to specify the LED retrofit lighting system with lower lumen output to ensure adequate brightness before the system is dimmed. Programmable drivers are becoming very common, and many have a CLO (constant light output) mode where the driver is programmed to the current needed to meet the target illuminance when the system is new and then automatically increases the light output at a predetermined rate, such as by 1% per year.

Consider installing LED troffers with integral luminaire level lighting controls (LLLCs) for greater energy savings opportunities.

READ MORE

Energy-Saving Strategies for Luminaire Level Lighting Controls

EXECUTIVE SUMMARY

The Lighting Research Center at Rensselaer Polytechnic Institute (LRC) conducted a study to determine how various parameters affect the energy savings from luminaire-level lighting controls (LLLCs), also called luminaire-integrated controls, in an open office setting. The investigated parameters were:

1. The field of view of the built-in motion sensor.
2. The delay time between when the last occupancy is detected and when the luminaire is turned off or dimmed.
3. The number of luminaires that turn on and off together in groups.
4. If the luminaires dim to a low level or turn off completely when no motion is detected.

Laboratory measurements were made of five LLLC motion sensors that were commercially available in 2015 and 2016 to determine the field of view of each when detecting medium motion. Field measurements were made in a 47.5m x 19.5m (156ft x 64ft) open office with a 2.6m (8ft 7in) high drop ceiling that included 60 occupied cubicles. A photometric simulation was conducted to determine a simulated layout of 2ft x 4ft LED troffers that would provide an average illuminance of 323lx (30fc) on the work plane. At each location in the open office where a troffer would be in the simulated lighting layout, two data loggers with motion sensors, one with a wide field of view and one with a restricted field of view, recorded the occupancy over two days. The recorded data was used in a custom Matlab program to determine when each luminaire in a simulated installation of would be on, dimmed, or off over the two days, and total energy use was calculated. Twenty-one simulations were conducted to determine how energy use varied with changes in the four investigated parameters.

The results illustrated that LLLCs have significant energy savings potential in open offices; the average energy use of the 21 simulations represented a 43% energy reduction compared with the calculated manual-control base case.

The results also showed that choices made during LLLC selection (e.g. sensor field of view) and commissioning (e.g. delay time, grouping, dimming vs. turning off during vacancy) have an impact on potential energy savings. For example, in the monitored open office:

- Setting the delay time to 5 minutes reduces energy use by 21% compared with using the typical default of 20 minutes.
- Leaving troffers ungrouped reduces energy use up to 29% compared with connecting troffers into groups of 8.
- Selecting a narrow field of view sensor LLLC reduces energy use by 18% compared with using a wide field of view sensor.
- Turning off troffers completely during vacancy reduces energy use up to 14% compared with

dimming troffers to 20% light output when vacancy is detected under the troffer but there is occupancy elsewhere in the room.

Additional savings are likely to result from setting the high-end trim (task tuning) and from the photosensors built into LLLCs. This study addressed energy savings only from motion sensors.

Selecting LLLC products and settings for maximum energy savings has the potential to adversely impact occupant satisfaction. Lighting specifiers and installers need to balance energy savings with the needs of occupants, though these human factors considerations were beyond the scope of this study.

Introduction

Automatic lighting controls for interior commercial spaces can be grouped into three categories:

1. Zone controls. One motion sensor and/or photosensor control multiple luminaires.
2. Luminaire-level lighting controls (LLLCs), also called luminaire-integrated controls. One motion sensor and photosensor are integrated into each luminaire. In many products, the LLLCs in multiple luminaires can be programmed to communicate with one another directly through a mesh network for the purpose of grouping luminaires.
3. Connected lighting. The luminaires are connected to a central control system, which may also be controlled and monitored remotely via the internet. The luminaires often have integrated controls, but may rely on connected zone controls instead.

This study focused on the second category, LLLCs that are not connected to a central control system, though the energy savings results would be applicable to connected lighting as well. The primary reason for the interest in this category is that studies have shown that in open offices, LLLCs have the potential to reduce energy use compared with traditional zone controls (the first category), but do not incur the additional installation capital and labor of connected lighting (the third category). Zone motion sensors reduce energy use in open offices by only 10% compared with manual switches because if even one occupant is present in an area, then all of the lights are turned on.[1] In contrast, a number of studies have found that luminaire-integrated controls reduce energy use by 47% on average compared with manual switches because the sensors have finer spatial granularity.[2]

Despite the previous studies on these controls, there has been a lack of understanding of how changing some parameters when selecting and installing LLLCs will impact energy savings in open offices. The parameters investigated for this study were:

1. The field of view of the built-in motion sensor. The wider the angle covered by the motion sensor, the lower the expected energy savings because more motion events will trigger the luminaire to turn on.[3]
2. The delay time before the luminaire is dimmed or shut off when no occupancy is detected. Delay times guard against false negatives in motion sensors; the longer the delay time, the greater the chance the occupant will make a sufficiently large motion before the light is turned

[1] Jennings, J., Colak, N., & Rubinstein, F. (2002). Occupancy and time-based lighting controls in open offices. Journal of the Illuminating Engineering Society, 31(2), 86.
[2] This is based on an unpublished literature review conducted by the LRC in November 2015. Seven studies covering 11 installations were included in the review. The literature review is available upon request.

off, thereby reducing the chance of annoying the occupant. However, when the monitored area is actually unoccupied, the delay time results in wasted light.

3. The average group size of the luminaires. In LLLC products that can form mesh networks, luminaires can be programmed into groups so that if motion is detected by one luminaire, then all luminaires in the group will turn or remain on. Typically, they are programmed using a hand-held remote-control device provided by the manufacturer. Occupants may wish to group luminaires for aesthetic reasons or to identify a cohesive work department. However, the greater the number of luminaires in a group, the greater the energy use. For example, if the number of luminaires grouped together is equal to the number of luminaires controlled by a traditional zone control, then the energy savings should be the same as that from traditional controls (approximately 10% compared with manual controls, as discussed above).
4. Switching off versus dimming. At least one manufacturer offers the feature that luminaires can dim to a low level rather than turn off completely when no motion is detected under that troffer, but there is still occupancy detected elsewhere in the room.[4]

[3] From a human factors standpoint, if the field of view is too small, then the light might not turn on even when there is motion in an area the troffer is intended to illuminate, but investigating this was beyond the scope of this study.
[4] This is the default functionality of the Philips SpaceWise DT LLLC, for example. http://images.philips.com/is/content/PhilipsConsumer/PDFDownloads/United%20States/ODLI 20170627_001-PDF-en_US-PLt-17062UM_SpaceWise_DT_user_manual.pdf. Page 13. Accessed

READ MORE

7 Tips to Maximize LED Retrofits

By Janelle Penny

What are your priorities for your next lighting project? Are you aiming for energy savings? Is the constant need to replace failed lamps cutting into the time you could be spending on other maintenance? Or are you just not happy with the quality of your existing light sources?

LED lighting could help solve these issues. This ultra-efficient light source is more affordable than ever thanks to plummeting component prices and energy efficiency incentives. If you're thinking about taking the plunge, make sure your LED retrofit delivers maximum value with these tips.

1. DEFINE THE PROBLEM

What issue are you trying to solve with an LED retrofit? Are you mainly prioritizing energy savings, or are there other problems that the new installation needs to solve too?

The General Services Administration (GSA) recommends asking yourself these questions to help define your needs:

- Is the space already overlit?
- What are your current and future lighting needs?
- How long do you plan to occupy the space?
- Do you want to incorporate sensors into fixtures?
- What control capabilities are you looking for, even beyond your lighting system?

For the Waukesha (WI) School District's natatorium, energy savings was a high priority, but the need to improve lighting conditions was also urgent. The existing metal halide fixtures had a half-life of about 8,000 hours, by which point they would lose around 40 percent of their original light output, says Jeff Gatzow, vice president of Optec LED Lighting, which manufactured and installed the new LED lamps used in the natatorium project.

Bringing in a lift to change the lights was so needlessly complicated that the bulbs typically wouldn't be replaced until they failed, which created a safety issue, noted Tom Cherone, master electrician for the Waukesha School District.

"The maintenance was also extremely time-consuming. We had to shut the pool down because you can't have people around when you're working with an aerial lift," Cherone said. "The fixtures were tempered glass—if the glass breaks and falls into the pool, you don't have a lot of options other than draining it, which becomes extremely expensive when you have to pay for sewage and

water fees to refill 480,000 gallons. With the new LED heads, each one is a sealed unit and the components are sealed as well so if they do fail, it's a simple operation to just drop the head and put a replacement in its place."

To get a handle on your building's needs, Vikrant Mahajan, product marketing manager for OSRAM SYLVANIA, recommended assessing every space in the building to examine existing light levels, control requirements, maintenance expectations and other factors that could impact your LED choices.

One way to do this is with a comprehensive audit that accounts for every light source in your building. Juliann Rogers, director of energy for CKE Restaurants Holdings Inc., oversaw an audit and LED retrofit of 204 Hardee's and Carl's Jr. restaurants nationwide. The company participated in the DOE's Interior Lighting Campaign, which encourages FMs to install high-efficiency lighting and has set an initial goal of 1 million efficient troffers installed.

"We had retrofitted several dining rooms with LED kits two to three years ago. We didn't want to tear those down and reinstall them because they were still fairly new, so I provided my auditor with a scope of work that said to audit the kitchen only in any restaurant where we'd already retrofitted the dining room," Rogers explained. "I would recommend having them audit the entire restaurant. If a fixture is LED already, they can make a note about that, but at least you'll know."

2. UNDERSTAND UNIQUE CHALLENGES

Special spaces may have more requirements than a standard office. For example, the natatorium project required fixtures that were IP rated for at least a damp location. "Even though it's a controlled environment with air conditioning and dehumidification, humidity still creates a problem," Cherone said.

Preventing glare was also crucial for safety and navigability, so Optec used an indirect lighting strategy where the light was angled onto the ceiling first and then back down into the water to ensure the pool was adequately lit while minimizing glare.

Weather and the ability to stand up to tough kitchen environments were crucial considerations for the Hardee's and Carl's Jr. retrofits, Rogers noted. She sought out recommendations from trusted suppliers who were familiar with the restaurants' needs.

"A lot of new fixtures don't have a removable lens, but in the Southeast, bugs will get into fixtures no matter how airtight they are. We need to be able to remove lenses for cleaning," Rogers said. "We chose to go with whole fixture replacements instead of retrofit kits due to the warranties and the price on the troffers, which were nearly equal to the kits. We also needed several different varieties of the same fixture—for example, a 2-by-4 troffer also needs to come in 1-by-4s and 2-by-2s and look the same."

3. CUSTOMIZE SOLUTIONS TO EVERY APPLICATION

Use the audit results and your assessment of your own needs to further narrow your lighting options. Rogers used footcandle measurements to select fixtures after determining that the restaurants needed 30-50 fc in the dining room and 80 over the order counter and in the kitchen area.

"The biggest challenge was figuring out what fixtures would work under awnings. We have a

lot of different types of awnings, and you can't just look at lumens per watt to be confident that a fixture will illuminate the awning from top to bottom and wash the wall – you have to actually install them to determine that," Rogers said. "I also did a lot of testing to make sure the color temperature was right for our signs and menu boards. Depending on your color schemes, some Kelvin temperatures will wash out the colors."

Bill Conley, an IFMA Fellow, LEED AP and facility manager whose organization is participating in the GSA's Interior Lighting Campaign, found significant overlighting on the exterior of the three 100,000-square-foot facilities on his site. Right-sized retrofits for overlit areas can save even more energy and money than a simple like-for-like exchange could.

4. REVIEW PRODUCT DESIGN

GSA recommends doing a mockup for all retrofit projects, especially if the replacement lamps will use the existing sockets. "For one-to-one replacements, compare light distribution to determine if the light levels will be comparable when switching from an omni-directional (fluorescent) to a directional (LED) light source," GSA suggested. "Use the mock-up to assess the complexity of re-wiring for a retrofit lighting system."

There are pros and cons to using the existing infrastructure, Conley noted: "If you use an existing ballast, you have ballast replacement to be concerned with, but if you go without it, you're dealing with direct electricity because the ballast acts as a buffer," he explained. "If you use drivers, that costs more and the drivers likely don't have the same life that the LED lamp itself has, so you're looking at replacement again."

Whether or not you choose to use existing ballasts, GSA recommends specifying products that can adequately dispose of heat because high temperatures can damage LEDs. "It's best to ensure the installing contractor follows the manufacturer's instructions in regards to clearances and ambient operating temperatures," the agency added. "Make sure to test and spot check your inventory to scan for driver issues or other non-obvious manufacturing defects."

The products should also be properly labeled and certified, said Jody Cloud, owner and founder of YES LED Lighting and author of *Say Yes to LED Lighting: Our Strategy for Excellence*. A UL logo indicates that the product is at least safe, and a voluntary certification from the DesignLights Consortium (DLC) indicates that the product meets minimum performance standards in distribution efficacy, color and longevity.

"If you're going to spend half a million dollars renovating a couple of office buildings, you want to make sure that those products are going to be around long enough for you to get a good return on investment," Cloud explained. "Authenticate everything."

5. OPTIMIZE LIGHTING CONTROLS

Lighting control systems can further drive down your space's lighting power density and help you derive maximum value from your new LED lighting, GSA notes. Some can dim your LEDs initially and increase light output over time to counteract the gradual degradation, while others have additional features such as zoned control and occupancy detection.

"Review the capabilities and compatibility of the drivers with the proposed control solutions, both hardware and software. If the controls are not integrated into the lighting fixture, it's best to get the controls representative together with the fixture manufacturer to verify compatibility," GSA recommended. "Test communication strength for wireless control systems, especially in buildings with heavy masonry."

If your control system is wireless, ensure that the communications protocol that the lighting controls use doesn't interfere with other wireless systems in the building, said Sachin Andhare, director, Vertical Markets, Commercial Office for Acuity Brands: "Many systems have built-in channel hopping to avoid interference."

6. COORDINATE CAREFULLY

A retrofit covering multiple sites requires extra attention upfront. Rogers recommended using the same company that conducts your audit to handle the ordering and installation—fewer handoffs between vendors means fewer opportunities for miscommunication. If you have a large portfolio, consider having the manufacturer ship supplies to every building ahead of time to eliminate potential ordering hiccups.

"If you're rolling out a lot of restaurants, for example, one little hitch like a backorder on something means you have to hold off on that store and it throws your whole schedule off," Rogers explained. "If there's time before the rollout, either bulk order products and stage them at every store or have your manufacturer stage them, package things together, and ship them palletized and marked for the individual stores."

7. KEEP UP WITH CLEANINGS

LEDs have a fairly long service life compared to other lamp types, so as long as you purchased quality products, the installation went smoothly, and the new lighting system is operated within the parameters specified by the manufacturer, your lighting system should remain hands-off for years. However, GSA suggested that you continue the regular cleaning you're already doing on your existing lighting.

Lighting Challenge 1

Office Campus | Cypress, CA

Facilities

Three interconnected buildings of roughly 100,000 square feet each (one of which is a warehouse), plus a large parking area.

Existing Lighting

Office areas have 1,500 troffers containing 3,000 2-by-2 fluorescent T8 lamps.

The warehouse contains 1,200 light fixtures contained in contiguous strip lighting. The parking lot and building exterior have roughly 150-160 lamps, including 20 1,000W HIDs and some 480W metal halides.

Problem

Energy and cost savings are top priorities. Overlighting presents opportunities for additional savings, especially with the exterior lighting.

Solution

The 1,000W HIDs have been changed out to 140W LEDs that provide about the same amount of light, while the 480W metal halides have been replaced with 100W LEDs. Future retrofit plans include tackling the pole-mounted lighting in the parking lot and determining whether to redesign the strip lighting in the warehouse.

To spread out the costs, the warehouse, office and exterior lighting are treated as three separate projects, a strategy that also allows the savings from the initial retrofits to help pay for later ones.

"Make sure you're putting appropriate lighting in appropriate places," suggested Conley. "One of the major challenges I see in the workplace, especially with retrofits, is that everything is replaced with the same intensity of light. You don't need the same type of lamps in every area—for example, in Research & Development, we need 72 footcandles at the desktop because they do fine work, but we don't need 72 footcandles at the floor level in the warehouse. Don't take a cookie cutter approach. Figure out what your needs are and what lamp fits that need."

Lighting Challenge 2

CKE Restaurants Holdings, Inc. | Nationwide

Facilities

204 corporate-owned Hardee's and Carl's Jr. restaurants

Existing Lighting

Each of the 105 Carl's Jr. and 89 Hardee's locations has about 35 troffers in either 1-by-4 or 2-by-4 configurations. Menu boards and outdoor signage are also lit.

Problem

The potential energy cost savings were top of mind for CKE, according to the GSA's Interior Lighting Campaign, which counts CKE as one of its initial participants. The retrofits are also helping the company achieve its long-term sustainability goals and customer feedback has indicated that the lighting quality has improved as well.

Solution

All of the 6,800 troffers were replaced with one-to-one LED versions, as were the under-awning lights and soffit lighting outside. The signage was retrofitted with a daisy-chain type of LED. Parking lot retrofits are generally one-for-one replacements with a target foot-candle range of 3-5 at the ground.

The company now plans to demonstrate the potential savings from a retrofit to franchisees, who will be able to take advantage of the incentives and aggressive warranty that were negotiated with the lighting manufacturer during the corporate retrofit.

Lighting Challenge 3

Waukesha School District Natatorium | Waukesha, WI

Facilities

A state-of-the-art pool with spectator seating that hosts swim meets, lessons and other events. Constructed roughly 10 years ago.

Existing Lighting

42 1,000W metal halide fixtures

Problem

The metal halides were encased in tempered glass that could break thanks to the heat generated by the 1,000W fixtures. If glass fell into the pool, all 480,000 gallons would have to be drained and refilled, which was extremely expensive and time-consuming. Dark spots from failing lamps also presented safety issues.

Solution

All 42 metal halides were replaced one-for-one with 240W LED high bays, resulting in an energy savings of roughly 70 percent. Future maintenance is simplified thanks to an easy-to-maintain design.

"All light fixtures get dirty, and cleaning a fixture can improve light output by 10 percent," the agency noted. "It is recommended that you clean your lights—whether LED or fluorescent—on at least a biannual basis."

Waukesha School District Natatorium, Waukesha, WI Credit: Optec

READ MORE

Lighting Design

By Todd Givler

History

While observing lines of dirt and debris frozen in a glacier, the British physicist, John Tyndall noted in 1860 that more light on an object did not necessarily increase its visibility. Despite this observation, cheap and abundant electricity led to lighting design in the mid twentieth century that meant little more than sizing branch circuits large enough to safely deliver power to the light bulbs. A philosophy of, "More light, better sight" summarized the approach to architectural lighting. Lighting control was unnecessary as illuminated (but empty) buildings defined the nighttime city skylines.

Opportunity

Recognizing perhaps what John Tyndall observed over 150 years ago, the relatively new lighting design profession takes a more refined approach to providing visibility for the occupants and enhancing architectural forms rather than flooding a space with light. The approach also represents an enormous business opportunity in the form of energy savings in new and retrofit construction. The Energy Information Administration estimates that electricity used for lighting in US commercial buildings totaled 297 billion kWh in 2010. This represents about 22% of total commercial building electricity use in the United States. Ironically, much of this commercial building occupancy takes place during daytime hours when daylight could provide for some or all of the lighting requirements without any electricity use at all. Contemporary electric lighting design captures this electricity savings opportunity while improving visibility in the built environment.

DESCRIPTION

Role Of Professional Lighting Designer

A lighting designer brings knowledge and expertise of a quickly expanding array of available lighting equipment and technology. Because a designer neither sells nor installs lighting equipment, the design is based on an objective understanding of the project goals and budget. While electrical engineers can design a lighting system, that design is most likely based on electrical requirements and code standards but may lack the aesthetic sensitivities to the overall architectural design.

Art And Science

Lighting design requires a technical understanding of electricity, light sources, and vision while also a sensitivity to architectural and aesthetic issues. The end design needs to meet the visual requirements for human eyes performing an endless array of tasks while also illuminating the architectural forms and immediate environment.

Providing Visibility

Lighting designers understand that most building occupants do not necessarily want LEDs or wireless control—they want to comfortably see what they are doing. How to provide for this visibility summarizes the role of the lighting designer. How to provide this while enhancing the architecture, integrating with the available daylight, minimizing building energy use, and aligning with the overall construction process and budget summarizes the role of the lighting designer in a whole building design process.

Lighting In Whole Building Design

In the whole building design process, effective lighting design integrates with many other building systems and design disciplines.

Architecture:

Probably the largest impacts on electric lighting requirements and design come from the architectural orientation, massing, ceiling height, and section profiles that determine daylight availability in the building. Typically, south facing orientations, narrow floor plates, high ceilings, and open sections tend to bring more usable daylight into the building and correspondingly reduce the electric lighting use. Lighting designers should be brought onto the project team early in the design process so that they might have an impact on these early siting and massing decisions.

Lighting systems should illuminate the architectural forms and surfaces and needs to be well integrated. It may take the form of coves that uplight the ceiling or walls. Or it may be carefully selected luminaires that respond to the architectural elements or style.

Programming:

Designers must understand the use of each space and the tasks that need to be lighted. The criteria for both quantity and quality of light depend on the type of task performed in each space and work area.

Interior Design:

Interior design choices, such as surface finishes, can have a dramatic impact on the lighting system and how much light is required to make a space feel bright. Dark wood finishes require more light (and electricity) to brighten a space than light colored surfaces. The visual elements of lighting equipment must also coordinate with the interior design. Lighting designers need to work with interior designers so that both understand the impact of the other's design decisions.

Electricity Use:

Lighting designers have control over one of the largest energy consuming services in the building. As mentioned previously, visibility does not always increase with more light and more electricity. While much attention focuses on minimizing power density, total energy usage also depends on the total time that lighting is activated.

HVAC:

Lighting designers have the opportunity to not only reduce the electric energy use of lighting system, but in turn reduce the cooling load on the HVAC system. Coordination between the lighting and mechanical designers can capture this opportunity. Keeping plenum space low and avoiding conflicts between luminaires and ductwork also requires extensive coordination. Without this coordination, HVAC systems may be oversized and miss energy saving opportunities.

Structural Coordination:

Lighting designers must understand how a lighting system might be incorporated into structural elements: coves, beams, and columns; as well as what structural components may become lighted surfaces.

EFFECTIVE DESIGN (SUSTAINABILITY)

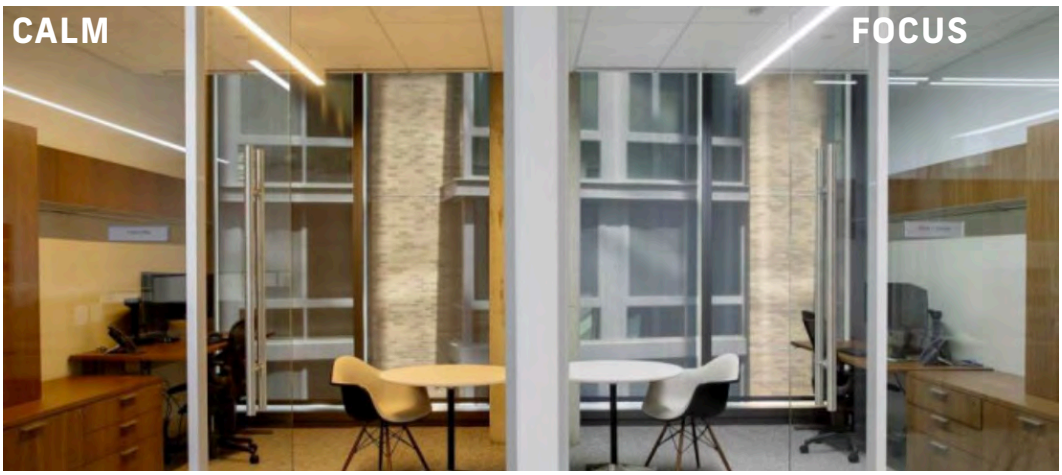
As part of a whole building design process, lighting designers develop an electric lighting solution that addresses:

- Daylighting—the design should supplement the available daylight.
- Task / Ambient / Accent systems—a lighting system that layers these components provides flexibility in its use and comfort.
- Control of systems—with daylight, occupancy, vacancy, schedule, time, and user preference.
- Efficient and effective luminaires—making the best use and distribution of the light source.
- Efficacious light sources—designer should choose the most efficacious (lumens of light per watt of power) that still accomplishes the design goal for that source and luminaire.
- Exterior Lighting—while enough light needs to be provided for nighttime visibility, too much can cause glare, adaptation problems, and light trespass.

READ MORE

How Hubbell's Color-Tuning Technology Transformed a D.C. Law Office

By Sarah Kloepple



Occupants can adjust and control both color temperature and intensity of certain fixtures. Switch stations are equipped with four presets (focus, work, normal and calm) for proper light color and intensity, from cool to warm. Credit: Hubbell

When the Michael Best law firm decided to consolidate its three Washington D.C. office spaces into one brand new space, LED lighting controls were at the top of the company's design wish list.

"It was very important to us to have a lighting system that was energy-efficient and very controllable," said Kevin Barner, managing partner of the D.C. office for Michael Best. "We had worked with this technology before with Hubbell, since they're one of our clients. We were definitely interested in their technology because we knew the details of it."

Barner said he looked at around 40 different buildings (about 12 of them in person) for the law firm's new space. The firm ultimately chose the new District Wharf development in D.C. for its location—still close to Capitol Hill and a beautiful view of the water—and its retail and restaurant offerings.

"It's like a destination here in D.C.—people have been coming in bunches down to the wharf for various reasons," Barner explained. "We jumped at the chance to build out a nice space where we could all consolidate."

COLOR-TUNING TECHNOLOGY

Now located at the new District Wharf development, the Michael Best law firm is outfitted with

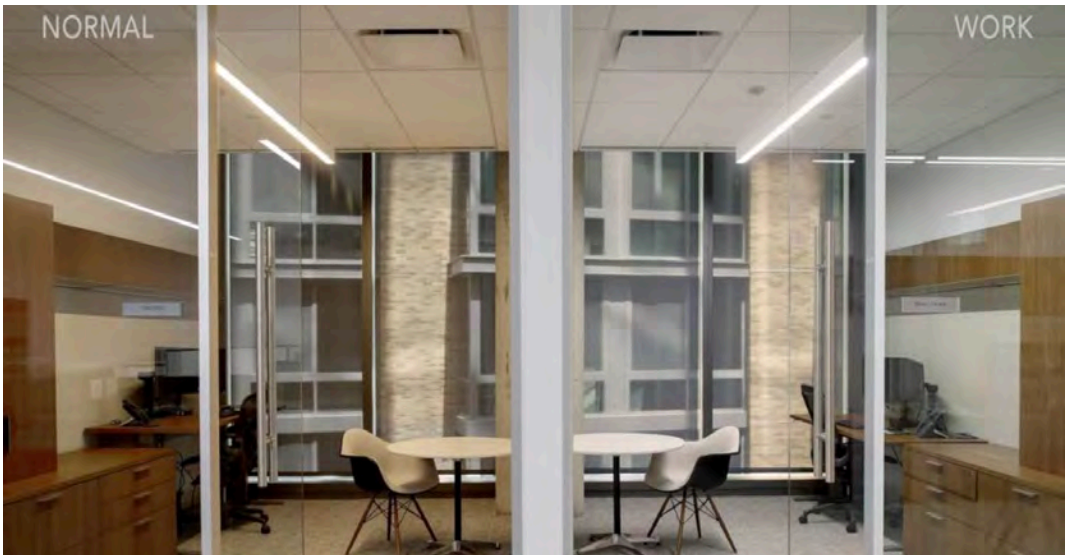
SpectraSync™ Color Tuning Technology. Occupants can adjust and control both color temperature and intensity of certain fixtures.

Switch stations are equipped with four presets for proper light color and intensity, from cool to warm.

- Focus—5000K
- Work—4200K
- Normal—3500K
- Calm—2700K

Other switch stations can adjust brightness and turn lights on or off in certain rooms or zones. All features are meant to allow occupants to control their lighting based on mood, work requirements and daylighting conditions. The color temperature controls are meant to simulate changes in outdoor sunlight levels.

"Our new office space has varying degrees of natural light," Barner explained. "There's one wall up against another building, while another wall gets direct sunlight, so we have different amounts of ambient light in the space. It was important for us to create a space that had consistent lighting and good lighting—from a color temperature and brightness standpoint—throughout."



Michael Best office color temps, normal to work

For example, a meeting space can be set to cool lighting during business hours and warm lighting during a social event. Employees can also adjust luminaires in their personal offices and workspaces to meet their preferences and to enhance the colors or visibility of their work materials in the space.

USING THE CONTROLS

With any new, cutting-edge technology, facilities managers and building owners should consider occupants' reaction to the change. Barner said Michael Best employees run the gamut when it comes to their amount of lighting control use, but there's a consensus that the technology is a

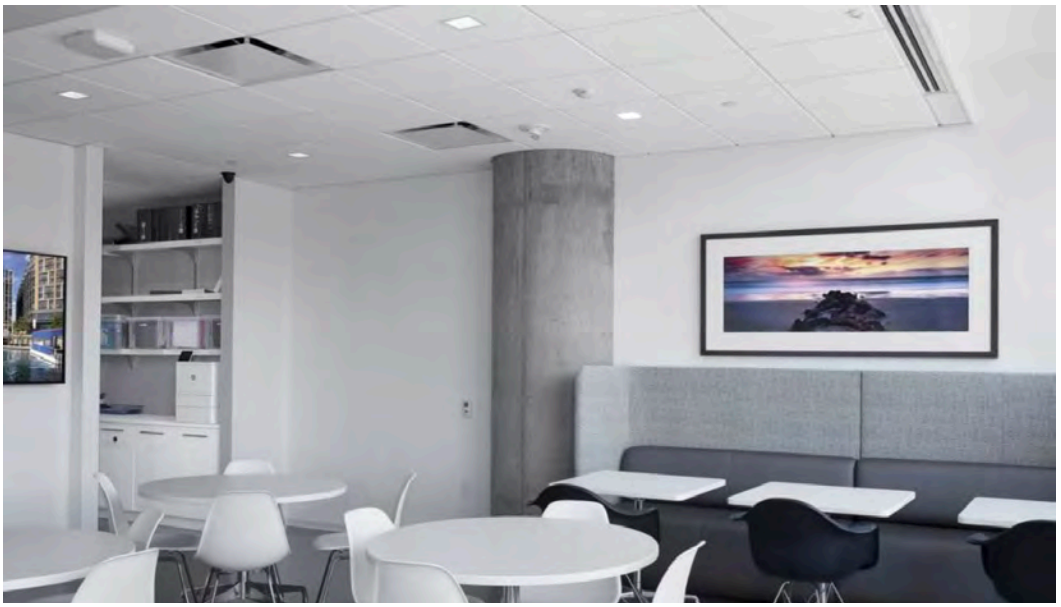
welcome change. Educating occupants on how to use the controls was key.

"Most people are used to a standard dimming switch," Barner said. But after guiding staff on how to properly use the controls and showcasing their benefits, an appreciation for the controllability and various options of the technology set in.

"We spend so much time in this space and having good lighting does affect people's moods," Barner said, adding: "We wanted to make sure we created a pleasant atmosphere for everybody to spend their day here and get a lot of work done."

"I was surprised to see how many folks changed their attitude and mindset. They really do appreciate the ability to control the lighting in their environment," he said.

WORTH THE INVESTMENT



After spending time in the space, Barner said visitors comment on the color-tuning technology's noticeable differences. The law firm even uses the lighting to attract potential new hires. Credit: Hubbell

Since the law firm moved into the District Wharf space in February 2019, Barner said the feedback on the new lighting system has been overwhelmingly positive. After spending time in the space, he said visitors comment on its noticeable differences. They even use the lighting to attract potential new hires.

Sophisticated sensors also allow the law firm to automatically adjust brightness levels, based on the amount of incoming natural light. And vacancy sensors have the power to override control of all fixtures to increase efficiency.

"The feedback has been excellent," Barner concluded. "No one thinks it's too complicated, and management has said it was worth the money."

The lighting system allows occupants to control their lighting based on mood, work requirements and daylighting conditions. The color temperature controls are meant to simulate changes in outdoor sunlight levels. “Our new office space has varying degrees of natural light,” Barner explains. Credit: Hubbell

READ MORE

A Symphony of Light for this Music Building

By Jane Jemmi

Voxman Music Building, University of Iowa

After the Iowa flood of 2008, the University of Iowa's School of Music realized it faced a dilemma: its facilities were spread across 21 locations in Iowa City. As a collaborative art practice, this displacement of the choral, orchestral and band ensembles was difficult for the college.

The former home of the university's music department featured two floors, low ceilings, classrooms on the interior and a windowless concert hall—difficult space to optimize harmony for both students and professors. The future of the department's new home, however—the Voxman Music Building—looked bright.

Facilities managers would dub this massive undertaking "the most complex building" on campus by any standard, according to Kayt Conrad, administrator for the Performing Arts at the University of Iowa. The project provided the opportunity to build a more welcoming place to serve as a beacon of light for prospective music students.

The desired outcome was a multi-floored building design that could isolate sound and function while becoming a place to congregate for students, staff and visitors. It consists of classrooms, concert halls, recital halls, offices and study spaces.

To be visually appealing, the building needed to incorporate natural lighting throughout the entryway and majority of the structure as well. Sound would have traveled throughout this musical space, had it not been for a boxes-within-boxes layout that floated slabs of concrete on top of each other to create a layered, distinct sound trap.

"The design concept was built around a 'bento box' in which there were small rooms and colored boxes within the larger box," said Michael Lindsey, associate principal at HLB Lighting. His team worked to support the overall vision of the architect.

Faced with a strict mandate that only six or fewer lamp types could be used in this project, HLB Lighting turned to LEDs as a financially feasible option that allowed for more muted light during the day and more engaging, proactive light during evenings and scheduled performances. This helped to "celebrate arrival in the entryway, as well as support wayfinding in the various performance halls in the building," Lindsey noted.

USAI Lighting, whose work is featured in many commercial and public spaces, provided the solution to many of HLB Lighting's designs.

"We turned to USAI Lighting for their help in modifying their BeveLED 2.1 cylinder, allowing us to fit within small plenum spaces and achieve the desired and clean integrated aesthetic throughout the building," said Lindsey. These prominent lighting fixtures were necessary to keep classrooms well-lit to accommodate rehearsals, performances and study sessions.

Ann Schiffers, senior vice president of USAI Lighting, recommended LEDs as they reduce maintenance and energy costs. As for placement of the lights, Lindsey noted that function and flexibility drove the location of lighting fixtures.

"Dealing with some high-volume spaces that were difficult to maintain, the design team had to work in concert with the University [of Iowa] and other trades to understand maintenance," he said. "A great example is that of the incorporation of architectural lighting within the spectacularly unique, undulating ceiling of the 700-seat performance hall."

HLB Lighting paired with acoustic teams, architectural experts, theatrical lighting designers and maintenance in order to locate lighting fixtures from accessible catwalks placed above the ceiling.

"We established a lighting schedule which would turn off the building in offline times, resorting to occupancy sensor control of lights in lieu of them always being on," said Lindsey.

Both student and staff needs were balanced through dimming control capabilities that were dispersed throughout the building. They were placed in individual faculty offices, group classrooms and performance halls to guarantee maximum flexibility across the board.

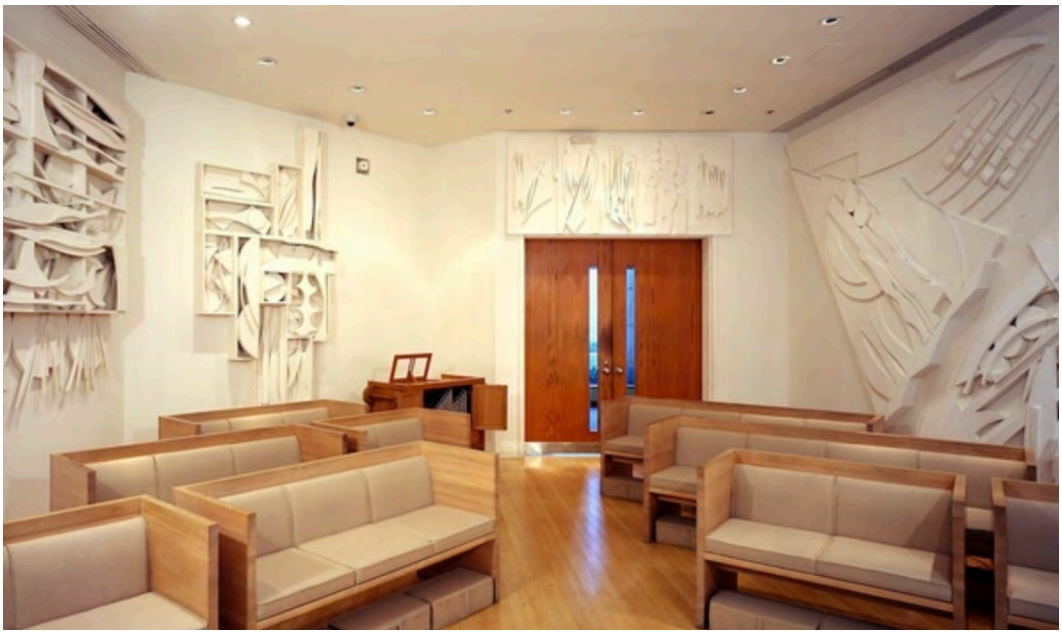
The result of the sustainable initiative from the design team was LEED Gold New Construction certification. Other green initiatives within Voxman include a green roof on an outdoor terrace, which reduces run-off, and a heating and cooling system that is quiet enough to be muffled in the facility, where music is considered to be purposeful sound perfume.

"The new Voxman Music Building demonstrates resilience and positivity and the forward-thinking nature of the University and shows that they didn't abandon the arts after disaster," said Kayt Conrad.

READ MORE

Lighting Upgrade Helps Protect a Priceless Work of Art

By Sarah Kloepple



A view of entrance to "Chapel of the Good Shepherd," with Nevelson's "Cross of the Resurrection" at left and "Grapes and Wheat" lintel over the door. Note: Not representative of the newly installed lighting program. Credit: Thomas Magno

How do you properly illuminate a priceless work of art? Museums around the world have found answers to that very question. LOOP Lighting, a New York-based lighting design company, needed to do the same when it took on re-configuring the lighting system for the Nevelson Chapel at Saint Peter's Church in New York.

IMPORTANCE OF NEVELSON CHAPEL

The midtown Manhattan church that houses the chapel, Saint Peter's Church, was completed in 1977 as part of the development of Citigroup Center.

The corporate/church/public facility is home to the only remaining comprehensive sculptural environment by modernist artist Louise Nevelson. Titled "Chapel of the Good Shepherd," the sculptural environment comprises nine white paint and gold leaf three-dimensional wood abstractions of thematic material from the Christian tradition, intended as a place of joy, peace and transformation.

The chapel is currently undergoing a $5.75 million restoration, partly funded by a Sustaining

Cultural Heritage Collections grant from the National Endowment for the Humanities and an art conservation grant from the Henry Luce Foundation. The former grant funds improvement to things like lighting or HVAC to provide long-term care that protects national heritage materials.

THE NEW LIGHTING

Ryoko Nakamura, partner at LOOP Lighting, led the lighting design effort on the Nevelson Chapel. LED lights replaced original bulbs, allowing for a decrease in the amount of heat and light damage on the artwork.

"We didn't know anything about this chapel [beforehand]," she said. "We went on a site visit and did a walk-through and saw the artwork, and it's a beautiful space. We were interested in providing lighting services and working with the team."

Under the direction of Kostow Greenwood Architects, who is leading the design team, art conservator Sarah Nunberg and Pastor Jared R. Stahler, LOOP Lighting created mockups of different designs before the chosen design was agreed upon.

"We came up with a more minimal approach, creating very clean perimeters," Nakamura explained. But mimicking the old lighting scheme using new LED tunable technology, while working with art conservationists, proved to be challenging.

The final design preserves the quality of the light as well as the shadows—so important to Nevelson, Stahler said, as she is regarded as the first sculptor to employ shadow as a formal element.

Recessed wall washer fixtures with LEDs hang above sculptures, allowing for fewer fixtures to fully light the sculptures as the artist intended, while at the same time reflective of the original fixtures and their layout. Track lighting allows for additional ambient lighting in the evening.

"Tunable white mixes natural and artificial light sources," Nakamura explained. "We tried to mix the color of natural daylight with the artificial LED lights. … The tunable [technology] changes the color and intensity of the LEDs throughout the day."

COMPARING TUNABLE LED LIGHTING CONTROLS COSTS

As the technology becomes more accessible, tunable LED lighting controls are proving to be a popular preservation tool. The high light quality and ability to control color temperature can do priceless works of art the justice they deserve. When considering relamping or retrofitting with this new technology, Nakamura recommended looking first at cost.

"Four to five years ago, retrofitting was still the best solution because of the cost of LEDs," she explained. "They're not that expensive anymore. Sometimes retrofitting costs more, takes more time and could be more difficult than having new lighting. It depends on the project, but you need to ask yourself, 'Do I want to retrofit or just have new lighting installed?'"

As the Nevelson Chapel reopened to the public visitors can rest assured that the artwork inside will be refreshed and well-illuminated.

READ MORE

Children's Hospital Lighting Embraces Calming Effects

By Sarah Klopple

SMP Engineering was tasked with designing the lighting for BC Children's Hospital. They selected Luminis' Syrios SY806 up/down pendants for the lobby, providing enough light to illuminate the floor below and provide uplight to accent the high ceilings. Credit: Ryan HK, courtesy of Luminis

The BC Children's Hospital serves the entire Canadian province of British Columbia, welcoming more than 200,000 patients each year. To meet the needs of its community, BC Children's Hospital recently opened a new $640 million Teck Acute Care Centre on its Vancouver campus.

Perhaps the most striking feature of the new facility is its entranceway and lobby – specifically, the lighting that was designed to create a sense of calm and warmth in these common spaces.

SMP Engineering was tasked with designing the lights for the exterior canopy of the entrance and main lobby. Its goal was to provide high levels of direct illumination to light the space and indirect illumination to highlight the wooden structure.

"The canopy is made out of structural timber," said Paul Fritz, senior project engineer at SMP, "which is well suited to receiving light, as well as providing soft light that enhances how the place feels."

Fritz added that before, the hospital appeared dated and old. "Even though it met the requirements at the time it was built, it was looking dark and worn and wasn't conducive to what the modern thinking is with respect to how a hospital and healing environment should work, especially for children," he recalled.

SMP wanted a power source for the lights that wasn't too visible, like an electrical conduit that would run across the ceiling. They modified construction to insert junction boxes instead. Credit: Ryan HK, courtesy of Luminis

The lighting design creates a well-lit pathway while highlighting the warmth of the wooden exterior canopy. Credit: Ryan HK, courtesy of Luminis

LIGHTS SET THE MOOD

To – quite literally – lighten the mood of the new children's hospital, SMP selected Luminis' Syrios SY806 up/down pendants for the interior lobby lighting.

The design blends with the contemporary architecture of the hospital – its 8-inch cylindrical pendants deliver enough light to illuminate the floor below and provide uplight to accent the more than 20-foot ceiling.

The Syrios light module can be aimed precisely where it is needed. In this case, it's needed to highlight the hospital's beams and ceilings.

Fritz said there was much coordination between SMP, architects out of Vancouver and Seattle and a ceiling supplier to install the lights.

The varying heights of the exterior canopy called for a combination of direct and indirect pendants and surface-mounted fixtures. "In order to get a conduit and power to those lights, we were trying to do it in such a way that wasn't visible," he explained. "We didn't want to have a nice beautiful wood ceiling, then have an ugly electrical conduit running across it."

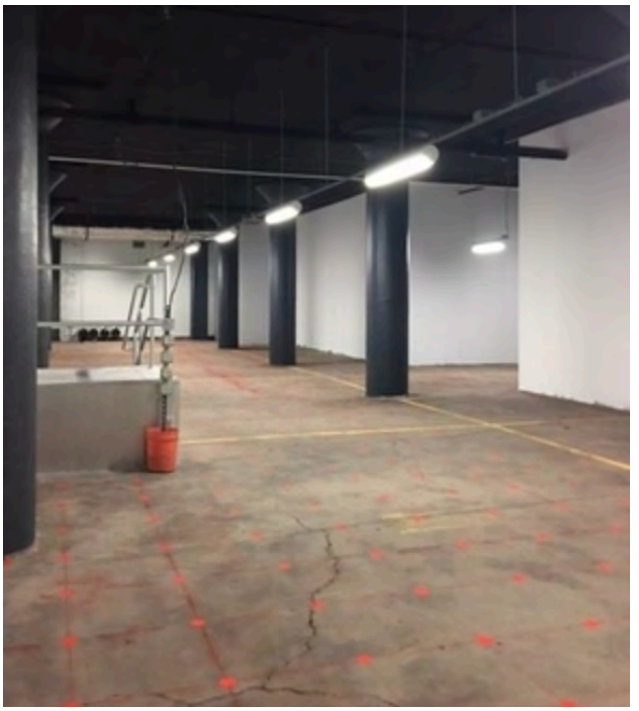
The solution: Construction was modified to allow for the insertion of junction boxes for light support and to hide the conduit system that services the lights.

The exterior canopy presented its own set of challenges because of varying heights, so a combination of direct and indirect pendants and surface mounted fixtures were used.

READ MORE

Lighting Upgrade Transformed this Data Center

By Sarah Kloepple



This is the facility before it was upgraded. Credit: H5

Data centers are fairly new commodities in the world of facilities management. Over the past decade, they've become more of an industry in their own right – but there're still many manufacturers that don't develop specific products for data center use.

That's the challenge that H5 Data Centers, privately owned data center operator, was faced with when it prepared to upgrade the existing fluorescent lighting products in a newly purchased Cleveland facility.

The company was looking to reconfigure a 3,500-square-feet data hall with an energy-saving system that improved light quality and was reliable, easy to install and aesthetically pleasing.

"We work in critical systems that can't ever go down," says Bill Johnson, vice president of colocation and data center operations at H5. "So it becomes very critical that these areas utilize highly reliable [lighting] systems. And systems that either generate very minimal heat or reject the heat that the servers are generating in the data halls."

THE NEW LIGHTING SYSTEM

When looking at what was available in the market, Johnsons says no product quite matched all their criteria. He explains that power management company Eaton was the only provider that agreed to create a customized product specifically for use in their data centers.

H5 worked with Eaton and ultimately came up with a series of very thin, 8-foot linear LED fixtures with a distributed low-voltage power (DLVP) system, a wiring system that provides low-voltage power and control in the same cable.

This is the facility after it was upgraded. Credit: H5

The 27 suspended fixtures were installed in one day, and Eaton even provided training to H5 employees on how the fixtures would be installed and how to service them beyond installation – meaning they don't have to contract out the expensive use of an electrician.

"[H5] specifically, they were interested in being able to use their own labor and work on their own timelines," recalled Chris Andrews, a product manager at Eaton.

THE RESULTS

Low-voltage wiring

The low-voltage wiring gives H5 the option to move the fixtures when needed. "That's important to us not only from a cost standpoint, but more from a standpoint of flexibility and timing," Johnson said. "We might have a customer that wants to move a row of their equipment racks. And they'd expect that to happen quickly, so we like the support for that."

Low energy usage and low heat

Not only are the lights LED, they are also motion activated. So when an H5 employee enters the room, the lights turn on and turn off when they leave. That results in low energy usage, since they're off until they're needed. That also results in low heat emission, a crucial benefit for data centers.

Visually appealing

H5 is able to be more aesthetically creative and softer with their new fixtures, especially with the LED

light and a built-in dimming option. "Overall, the light has a visually pleasing finish, unlike most data center lighting," Johnson explained. "The addition of the dimming feature, on the aesthetic side, was a great improvement."

Space efficiency

The new fixtures also take up less space in the data center. "Our ceiling has a tendency to get congested with cable racks and cable trays," Johnson said. "These lights use a very small ceiling footprint, so that was a big plus for us, too."

LOOKING AHEAD

Following the success of its Cleveland facility, H5 has made multiple orders for more Eaton DLVP fixtures, including for a recently acquired space in Quincy, Washington.

"DLVP gave H5 the best opportunity for good lighting, the aesthetics they wanted, along with a faster and simpler installation," Andrews said, adding: "This system was the answer as energy codes become more and more stringent and [lighting] becomes more granular in control. For example, rather than the Empire State Building flipping one switch on the main floor to turn on the whole building, we're trying to become smarter as a society and start controlling smaller, more granular spaces."

Johnson summarized, "We know we've made the right choice when customers visit the Cleveland space and go, 'Wow.'"

READ MORE

UV Light Disinfection Technology

Technology to reduce harmful pathogens and help people feel safer with a variety of science-based strategies.

Visit AcuityBrands.com/uvdisinfection to learn more

AcuityBrands.

Germicidal UV Light Disinfection* Technology by Design Approach

By Jeannine Wang, PE LC, Director, Technology Solutions - Acuity Brands Lighting

How ultraviolet light (UV) works as a disinfection technology depends upon the wavelength(s) being employed. The UVC band with a wavelength of 200-280nm has emerged as a highly viable solution for interior architectural settings such as offices, retail settings and schools, due to its proven effectiveness against both bacteria and viruses.

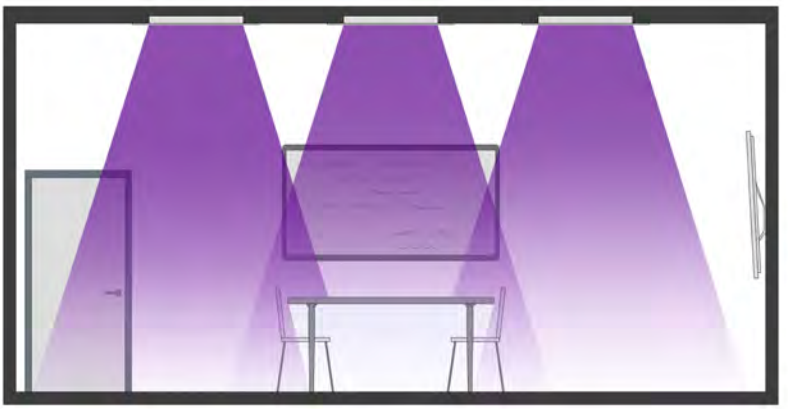
Also, UVC is straightforward to apply in a defined area and its predicted effectiveness can be predetermined within a set of application design parameters and in reference to measured output data and laboratory test data. When an adequate dose is applied, UVC light can treat an area quickly. Utilizing UVC pathogen control can reduce the amount of chemicals that need to be used for disinfection purposes.

When evaluating a space for application of a UV disinfection solution, there are several UVC-specific technologies to consider:

1. **Intense Room Disinfection Technology (using 254nm UVC wavelength) and Upper Room Disinfection Technology (using 254nm UVC wavelength)**

In general, UV technology solutions that use the 254nm UVC wavelength work well. This wavelength can effectively inactivate many common viruses and bacteria and it can be cost-effective to implement. This UV technology solution usually works with legacy fluorescent luminaires (and newer LED lighting systems).

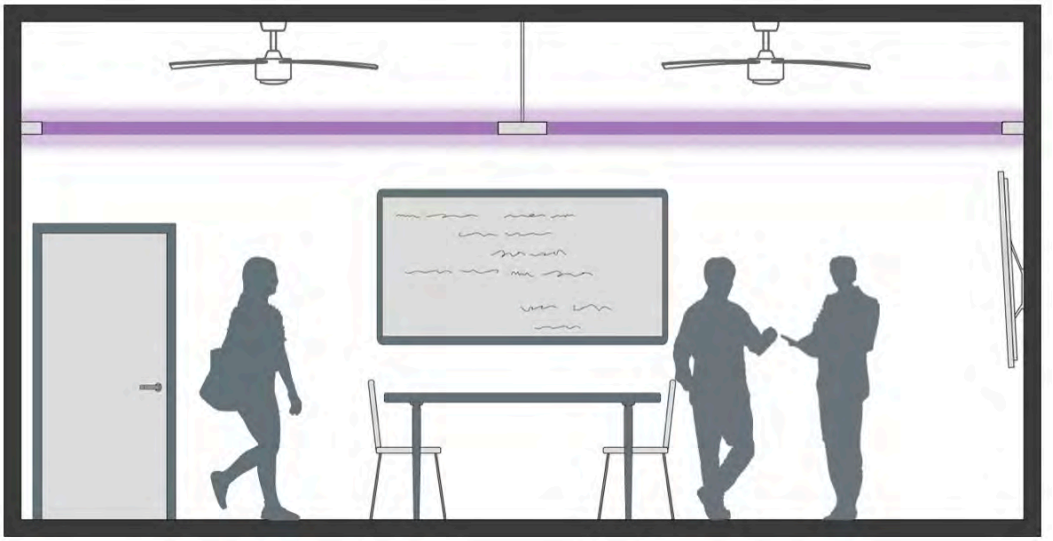
The 254nm Intense Room Disinfection approach cannot be used in a space while occupied due to concerns over injuries that can be caused by exposure of human skin and eyes to the 254nm UVC. Typically, this technology application would be used in the evening time or during off hours of room usage, in an hour-plus-long dose, to help control pathogens in the room.



Intense Room Disinfection Technology

Spaces: Operating rooms, school restrooms, gym workout rooms, teacher breakrooms and other high touch areas that can be treated while occupants are not present.

For the **Upper Room Air Disinfection** approach using 254nm UVC lamps, the UV light is aimed toward the ceiling, helping to treat the air that is circulating through the room. Although the UV light addresses the circulating air above the occupants' heads, it does not treat any of the surfaces below eye level in the space. While this technique does allow for the system to operate while occupants are present, assuming a 9 ft. ceiling height or higher, additional caution during commissioning is imperative to make sure any occupants are protected against UV overexposure from either direct or reflected 254nm UVC light. This approach is generally less obtrusive than the Intense Room Disinfection (254 nm) approach, but it is often more expensive on per-square-foot basis in comparison.

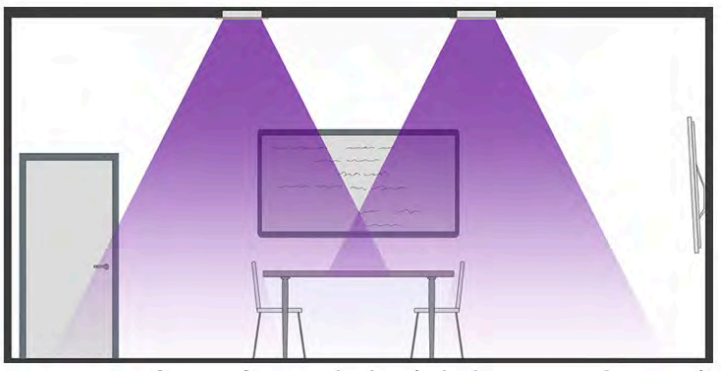


Upper Room Disinfection Technology

Spaces: Auditoriums, waiting rooms, medical clinics, public gathering spaces, gym workout rooms, classrooms, and other high touch areas that can be treated while occupants are present.

2. Intense Room Disinfection Technology (using pulsed xenon lamps)

Another solution is the Intense Room Disinfection approach using pulsed xenon-based technology, which is a relatively new type of UV disinfection technology. This approach is similar to the Intense Room Disinfection solution using 254nm UVC light, but is not as obtrusive when not in use, as the technology fits more easily into various fixtures and spaces. The pulsed xenon lamps have wavelengths ranging from 200nm up to 1,000nm, and they are exceptionally powerful. With the broad band coverage in UVA, UVB and UVC bands and high output, pulsed xenon is very fast-acting (typically used in a 30 minute cycle time) against many pathogens. Solutions that use pulsed xenon lamps can be considered for unoccupied spaces only.



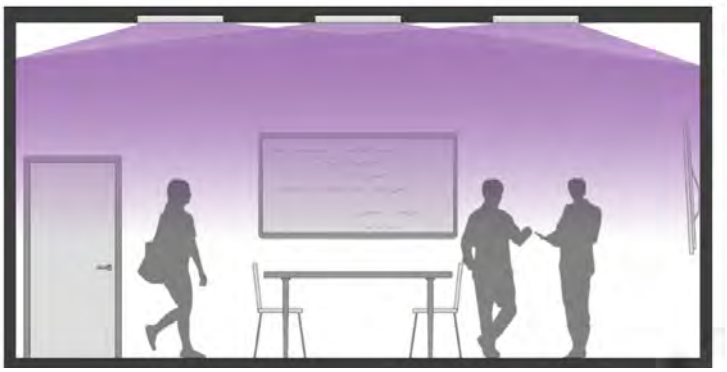
Intense Air & Surface Disinfection Technology (Pulsed Xenon - Broad Spectrum)

Spaces: Operating rooms, school restrooms, gym workout rooms, teacher breakrooms and other high touch areas that can be treated while occupants are not present.

3. Continual Room Disinfection Technology (using filtered 222nm UVC) and Luminaire Onboard Air Disinfection Technology (using targeted 254nm lamps).

A third approach to UV disinfection incorporates the filtered far-UVC light (222nm wavelength) in a **Continual Room Disinfection** solution. A primary difference in this approach is that laboratory studies suggest that filtered 222nm far-UVC does not pose a health risk for human eyes and have shown that this wavelength does not pose a health risk to human skin when used within appropriate parameters, which allows it to be applied throughout the day and night in occupied or unoccupied spaces for continual pathogen control.

To clarify, it is continual pathogen control and not continuous, meaning that this technology application can be turned on and off every few minutes on a regular cadence so as to remain within safety guidelines while providing ongoing pathogen control. For example, every three minutes or every six minutes this type of UVC light can be applied and occupants can have the freedom to work throughout that space at any time of day or night.

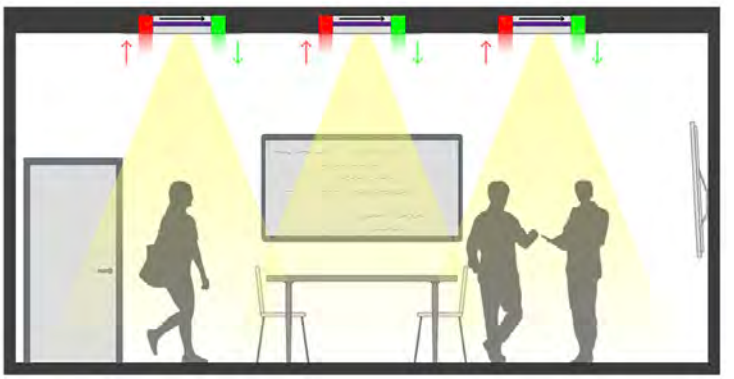


Continual Air & Surface Disinfection Technology (222nm)

Finally, **Luminaire Onboard Air Disinfection** technology is an offshoot of the 254nm solutions that provides a more targeted approach. It uses an enclosed fixture to take in air from the immediate

surrounding area and run it through its own filtration with a 254nm lamp with UV emissions fully contained inside. The luminaire then pushes that treated air back into the room. This approach is more localized to where pathogens are potentially introduced into a space. Therefore, it is able to treat the air and turn it over numerous times per hour right in the space where the occupants are located. It is also safer for occupants than other 254nm solutions because they are not directly exposed to the 254nm wavelength whatsoever.

Spaces: Offices, conference rooms, restrooms, house of worship, restaurants, retail, classrooms, and other high-occupancy spaces while occupants are present.



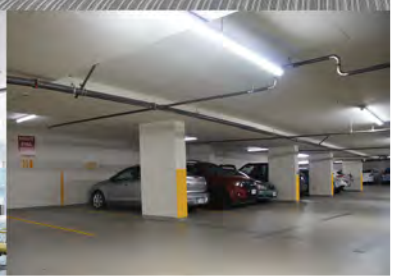
UV Onboard Air Disinfection Technology

While UV technology offers effective solutions for reducing harmful pathogens in architectural spaces, it is not a perfect solution. It can do a lot of the heavy lifting to provide pathogen control, but the technology needs to be used in conjunction with chemical and mechanical cleaning disinfection protocols to help ensure thorough disinfection. And because it is not a perfect solution, there are other aspects to consider in the overall strategies for spaces that would like to use germicidal UV as a way to help make spaces safer for the public.

Please go to UV light disinfection technology for more information.

Jeannine Wang is **Director, Technology Solutions for Acuity Brands Lighting** and is based in Oakland, California, where she has a leading role in accelerating market adoption of cutting-edge design platforms such as OLED lighting, circadian and dynamic lighting, and UV light disinfection technology. Jeannine is a Registered Professional Engineer (PE) in California, electrical discipline, and Lighting Certified (LC) by the National Council on Qualifications for the Lighting Profession (NCQLP). Jeannine currently serves as an advisory member for the IES Photobiology Committee.

**All references to "disinfection" are referring generally to the reduction of pathogenic bioburden and are not intended to refer to any specific definition of the term as may be used for other purposes by the U.S. Food and Drug Administration or the U.S. Environmental Protection Agency. The disinfection technology as incorporated in Acuity Brands products is not for use as or for medical devices. Reduction of the pathogenic bioburden is a function of fixture run time, distance to the UV light source, airflow, room size and/or other factors, and the level of reduction will vary within a specific space.*



Choosing the Right Luminaires Takes Vision.

VISIONEERING BRINGS THOSE CHOICES INTO FOCUS

Every part of a building serves a function, and Visioneering's luminaires deliver performance, quality illumination and personal control to enhance any space. From wireless controls to wellness solutions, Visioneering products are integrated with the latest technology. Viscor offers the quickest lead times in the industry and we can ship 90 percent of our Visioneeering products within 10 business days to anywhere in North America.

Next time you require the right lighting solution for your specific application, **Think Visioneering.**

Learn more at **Viscor.com/Visioneering**

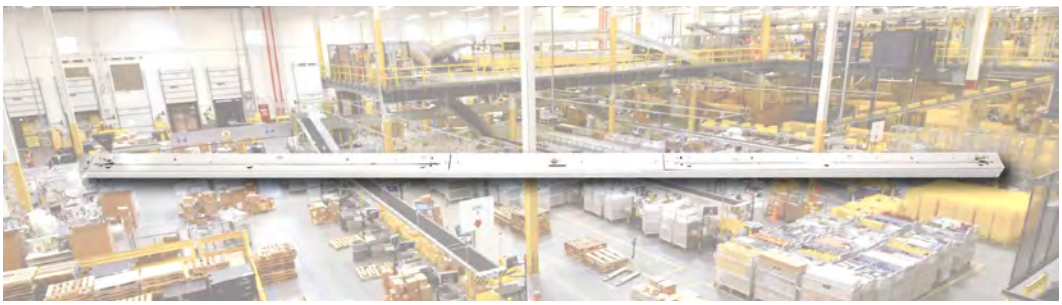
THE FUTURE IS ON®

VISCOR | a LEVITON company

Viscor Case Study

Amazon Static Shelf Storage Pick Modules

Bolton, Ontario, Canada



Project Overview

The Challenge:

Amazon Canada's Bolton fulfillment center is a one million square foot facility where employees will pick, pack and ship small items to customers such as books, electronics and toys. Their demanding performance spec required high output and narrow distribution throughout their picking aisles. The contractor needed unique solutions to meet spec in a short lead time while positioning them as the most competitive option.

The Process:

The advantage of being a North American manufacturer allowed for immediate and direct resolution for any potential inquiries or concerns regarding the job and products. Viscor worked directly with the contractor to develop several prototypes and test lumen outputs, light distribution and the installation process. This process allowed us to identify opportunities to meet spec while reducing labor costs and job-site complications for the contractor.

Our Solution:

Viscor developed fully custom LED luminaires to meet the spec and installer requirements. The space required the fixture forms to be an unconventional 5' and 10' feet long, which drastically reduced the installation costs by removing the need for over 48,000 feet of conduit. Each fixture featured multiple mounting holes and side knock-outs to allow for increased installation flexibility and reduced labor costs. In terms of functionality, our design also allowed for field installation of additional plug-and-play sensors, lensing and other options, post project.

VISIONEERING by VISCOR

amazon

$780,516 in savings

in annual energy savings which comes to $47.30 saved per fixture

50% reduced wattage

used per fixture (72w to 36w) with the use of integrated sensors

Custom Solutions

From integrated sensor controls to custom sized 5' & 10' fixtures to fit into their space massively eliminating conduit

Reliable Product

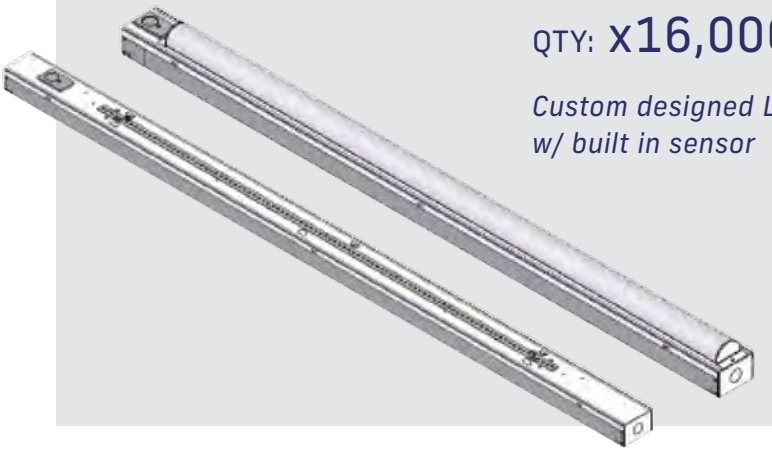
Name brand drivers & LED engines which results in the necessary guaranteed performance required for these 24/7 operating spaces

Featured Products:

Custom Strip

QTY: x16,000+ pcs

Custom designed LED strip luminaire w/ built in sensor



www.viscr.com

Nora Lighting expands its M2 Mini 2-inch LED Downlight Series with the introduction of a **recessed round elbow** in matte black or matte powder white finish. The elbow rotates 345 degrees horizontally, extends up to 70 degrees and delivers 500 lumens at 2700K or 3000K. The round downlight can be converted to a square with optional accessories. Each luminaire includes field changeable optics for precise illumination. M2 MINI ELBOW by NORA LIGHTING. www.noralighting.com

Acclaim Lighting's new IP67-rated **Outdoor Link System** quickly and easily links Dyna Drum and Dyna Accent series fixtures while eliminating excess hardware for lighting projects. The system allows the linking of up to 32 fixtures from a single power source without the need for a connection point at every unit. Includes "T" junction (OLS T), link cable (OLS L), feed cable (OLS F) and end cap (OLS EC) connection options. www.acclaimlighting.com

ConTech's new 24V Performance LED **Tapelight** offers specification options for higher lumen output and longer runs on a single driver with availability in Low (LO) and Super High (SHO) outputs. The new comprehensive offering provides lighting designers with more creative options to meet the needs of demanding architectural applications. 24V PERFORMANCE LED TAPELIGHT by CONTECH. www.leviton.com

National Specialty Lighting (NSL) added the new **LED Regressed Down Light** CCT to its down light offerings. This regressed down light offers visual comfort and performance, is available in 4-inch (9W) or 6-inch (12W) nominal apertures to suit most residential, retail and commercial applications. Offered in CCT tunable white in either 2700/4000/5000K via a three-position selector switch located on driver or Bluetooth wireless control option for a more dynamic range of 2700-5000K. LED REGRESSED DOWN LIGHT CCT by NATIONAL SPECIALTY LIGHTING. www.nslusa.com

Vive PowPak Phase Select modules offer a **remote mountable dimming** option that can easily adapt to the various phase dimming needs of a project. Simplify jobs and reduce the number of models you need to keep on hand. Modules feature Lutron PRO LED+ technology to dim smoothly down to 1% in either reverse- or forward-phase situations. Code compliance is easy with features such as configurable minimum light level which keeps the lights on at a user-specified minimum level. VIVE POWPAK PHASE SELECT by LUTRON ELECTRONICS. www.lutron.com

Amber Solutions introduced a solid-state **two-wire dimmer** solution that works without a neutral wire, is compatible with most types of LED lighting, offers flicker-free performance with a wider range of LED bulbs and fixtures, and provides smooth, precise dimming from 0% to max power. Intelligently monitors and controls the flow of electricity, eliminating all mechanical pieces used in existing solutions. TWO-WIRE DIMMER by AMBER SOLUTIONS. www.ambersi.com

Hydrel has released its Specialty **Architectural Flood** (SAF) light collection. Available in 9- and 12-inch diameters, the SAF family was designed to illuminate and accentuate architectural details of a building facade, to accent signage, landscape or hardscape elements of an open space, or to provide area lighting. SAF7 provides up to 5,000 delivered lumens and the SAF14 provides up to 9,500. SAF COLLECTION by HYDREL. www.hydrel.com

Luminis announced a wide range of its luminaires will now be offered with nLight AIR **wireless lighting controls**, a distributed, intelligent digital lighting controls platform with wired or wireless options that feature advanced technologies to meet the demand for greater functionality and enhanced occupant convenience while reducing energy consumption. Simplifies design and installation by embedding sensors directly into luminaires and providing a seamless connection to the nLight network. Designed to function as a standalone (one-room solution) or networked across an entire campus. NLIGHT AIR by LUMINIS. www.luminis.com

Celeste is a **decorative lighting disc** that is formed from artisanal casted glass. Features integrated connectors that allow individual Celeste heads to be connected vertically, providing the opportunity to create large impactful installations as well as smaller clusters. Offered in multiple canopy styles and in clear or frosted glass. Choose from one of more than 30 preconfigured configurations or create own unique display. CELESTE by EUREKA LIGHTING. www.eurekalighting.com

Cubebits is a set of **recessed linear downlights** that offers a 1.5-inch aperture profile in 3-cell, 6-cell, 9-cell or 12-cell units as well as mounting into the Amerlux Linea Pendants and Gruv recessed 1.5 linear profiles. Compatible with Grid, GB and wood millwork ceilings. Ideal for retail, hospitality and commercial environments. Discreetly designed in a black and white specular finished louver that exudes bold confidence. CUBEBITS by AMERLUX. www.amerlux.com