



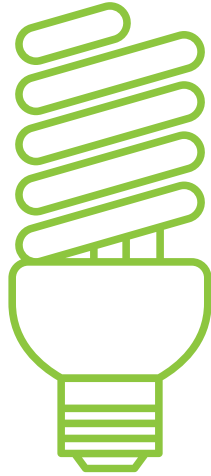
Commercial & Industrial LED Lighting Guide

How to make decisions about efficient and cost-effective LED lighting installations in commercial and industrial buildings.



mantisinnovation.com

877.459.4728



Let's talk lighting

Are you looking for energy efficiency solutions for your buildings?

Interested in understanding what an energy services company is and what role they play in efficiency projects?

Would you like to learn more about LED lighting controls?

We wrote this guide to examine, explore, and explain lighting retrofits and LED upgrades in commercial and industrial spaces.

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LED lighting is the backbone of energy efficiency

LED lighting is one of the most important [efficiency upgrades](#) available to commercial/ industrial buildings.

LED fixtures improve energy efficiency by requiring less power to produce light and having a long lifespan compared to other fixtures or bulbs.

Offering dozens of fixture types and wide implementation in both residential homes and commercial buildings, LEDs have evolved.

Since their beginning in the mid-twentieth century, they've become one of the most effective energy saving devices for facilities. Today, the best upgrade on the lighting market is undoubtedly LED.

LED stands for “light emitting diode” and is a device that uses electric currents to emit light.

Commercial and industrial lighting often uses energy at greater scale compared to fixtures in residential buildings. As a result, energy demand for lighting is typically about 15-20% of a commercial building’s energy bill. This usage can result in thousands – even millions – of dollars saved if retrofitted to a more efficient fixture type.

Proving itself a game-changer across industries, the humble LED light continues to deliver valuable energy savings with lots of other benefits for companies of all industries.



We created this guide to explain how LEDs work in commercial environments. You’ll learn why they’re an efficient choice and discover the benefits of LED lighting for companies.

Finally, we offer a breakdown of lighting considerations by industry.



Lighting and energy efficiency

Although lighting isn't the largest operational expense, it contributes to overall costs and is easily retrofitted for immediate savings. LEDs emit light in a specific direction, reducing the need for reflectors and diffusers that can trap light. This feature makes LEDs more efficient for many uses such as recessed downlights and task lighting. With other types of lighting, the light must be reflected to the desired direction and more than half of the light may never leave the fixture.

A long lifespan also contributes to the efficiency of LED lamps. Most LEDs have a rated life of well over 50,000 hours. For facilities operating 8-12 hours per day, this means 10 to 15+ years of use before the need to replace.

The following comparisons show the performance of LED lighting compared to inefficient lighting types:

LED LIFESPAN COMPARISONS

50x

longer than
incandescent

20-25x

longer than
halogen

8-10x

longer than
CFLs

Compared to incandescent lighting, LEDs last 50 times longer

Compared to halogen, 20-25 times longer

Compared to CFL, 8-10 times longer

Information source: [bulbs.com](https://www.bulbs.com)



Company types that install LED lighting solutions

For facilities management teams looking to retrofit or install LED lighting, there are three typical options for installation:



Energy Service Company



Manufacturer /
Distributor



Electrician

1. Energy Service Companies

Energy Service Companies typically offer LED lighting project engineering as one of several efficiency services. These companies design lighting as a solution intended to lower energy use and operational costs.

Additional benefits include improving working spaces, solving for facility needs and qualifying projects for additional funding. Financing options can involve local utility subsidies, incentive dollars, tax incentives and third-party business loans.



2. Lighting manufacturers or distributors

Lighting manufacturers or distributors produce and/or sell various types of LED lighting fixtures, lamps, ballasts and retrofit kits. Whether selling their own brands (manufacturers) or representing multiple product lines (distributors), these professionals may have the resources to audit existing facilities and propose lamp types or fixtures for a lighting upgrade.

They often work with energy service companies to source products and share new technologies.

3. Local or in-house electricians

All lighting projects require electricians to perform the work necessary for the retrofit or upgrade. Some in-house teams or third-party electrical contractors have the resources to select fixtures, source products and manage a lighting project installation.

However, for larger-scale installation or to qualify projects for utility incentives these teams work alongside energy service companies to complete electrical work required for lighting retrofits.

The biggest disadvantage to commercial/industrial companies that engage partners other than energy service companies for project installation is a lack of turnkey design and sources of funding.

Although lighting manufacturers/distributors or independent electricians can work on LED upgrades, these companies do not typically have relationships with utilities and a clear understanding of incentive programs.

Utility companies work closely with energy service companies to provide financial incentives for customers. At a high level, they do this because they don't want to build more power plants. By ensuring existing facilities operate efficiently (such as lighting), utilities can keep up with power demands as new buildings require energy from the same grid.



Energy Service
Company

Lighting
Manufacturer /
Distributor

Electrician

Can audit existing
facility lighting



Manages
product lines

Maintains relationships
with product
representatives



Installs fixtures
and re-wires
electrical systems

Maintains relationships
with preferred
electricians



Design projects to
lower energy use



Qualifies projects
for utility
incentives



Sometimes offers
incentive qualification

Turnkey service
offerings





How LED Lighting Works

The light emitting diode, or LED, is an electronic product that produces light by passing an electrical current through a microchip. This process illuminates the small light sources, or “diodes” in each fixture or lamp thus producing visible light.

Electrons move in the diodes, which operate here as simple semiconductor devices, to illuminate LEDs as they conduct the electrical current. LEDs do not use heat to create light, which contributes to their low energy use and long lifespan.

You can read more about how LED lighting works at:

[energystar.gov »](https://energystar.gov)
[howstuffworks.com »](https://howstuffworks.com)

Types and components

Rows of diodes with a driver to power them, housed in a fixture body, create the structure of LED fixtures.

Over time, engineers developed the technology of LED lighting and this (relatively) new way of creating light for many of the lighting products installed in commercial or industrial buildings.

The most common LED fixture types in commercial and industrial buildings are:

- **high bays**
- **recessed troffers**
- **linear fixtures**
- **recessed cans**
- **wall sconces**
- **track lighting**
- **pendant**
- **surface mount**

LEDs can also be found in residential spaces like your typical A lamp screw-in and recessed can.



Bulb Shapes

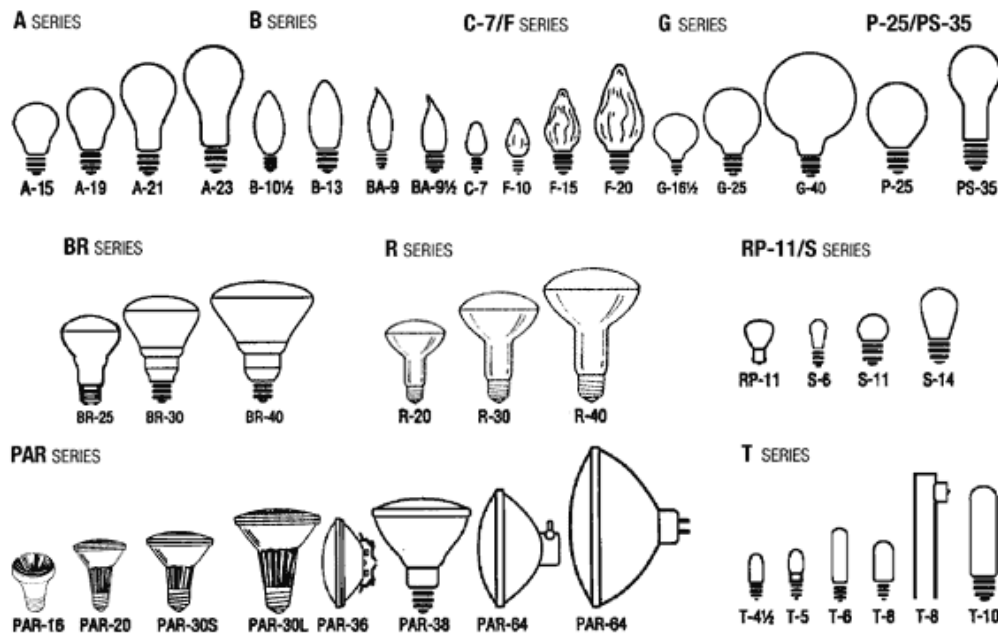


Photo source: [Bulborama](#)

Although a detailed task, it's very important during project installation to make sure the right LED retrofits are going into the correct fixtures.





For example, if the electrician retrofits a fixture with the wrong tube and driver combination, heat can be created and possibly damage the entire fixture over time. Simple mistakes like this can cause the need for additional retrofit projects in as little as one to two years or even create a fire hazard.

There are also types of built-in capabilities available for commercial and industrial lighting solutions. Examples include photocell technology, which enables light sensitivity, dimming control and integrated occupancy sensors within fixtures.



LED lighting vs fluorescents

Compared to other types of lighting, which can include fluorescent lamps or even older generations of LED, current LED lighting technology is different in several ways:

-  LEDs produce light in specific directions
-  Older forms of lighting produces more heat compared to LEDs
-  LEDs can come in any available color combination, as well as the more typical white and yellow shades
-  Current LED lighting has a longer lifespan

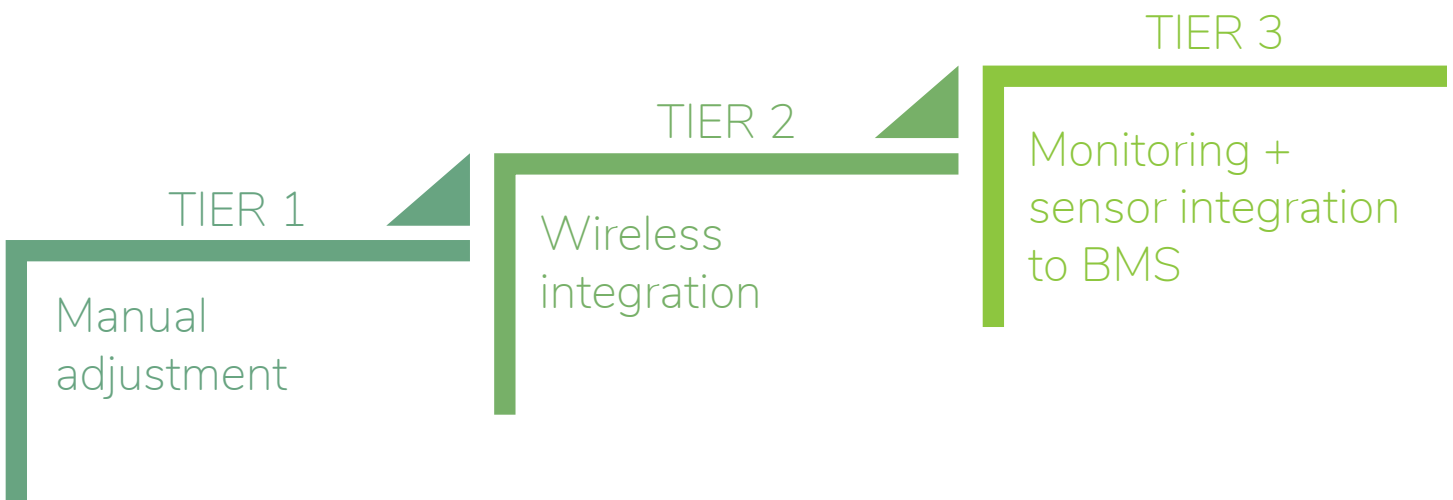




Integrating controls

When the fixtures and lamps are being upgraded as part of a lighting project, it's a good idea to consider the addition of controls. Lighting controls manage light output and can monitor power usage. These programmable systems integrate into individual fixtures.

Controls are available in three tiers and their capabilities correspondingly increase. Controls give operations teams increased ability to adjust lighting. When coupling these capabilities with LED lighting specifically, the resulting energy savings can be immense.



Tiers of controls (from none to fully networked)

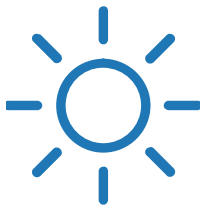
- 1. Tier One lighting controls** are limited to manual adjustments, such as a dimmer switch on the wall.
- 2. Tier Two lighting controls** have wireless integration which connects fixtures to each other, accessible via your chosen device.
- 3. Tier Three lighting controls** have high-level sensor integration which reports back your designated dashboard and can be linked to your Building Management or Automation System. This level of control can extend into asset management.



Types of controls

Controls allow for maximum efficiency and maximum lifespan of fixtures. Each type of control is programmable and can be adjusted when needed. **Color temperature and color tuning** are also managed with controls. Different abilities of lighting controls may include:

Control Types



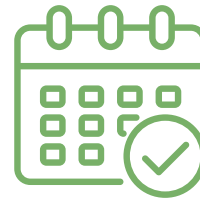
Daylight harvesting



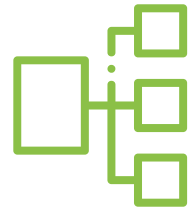
Occupancy sensors



High-end trim + low-end trim



Scheduling



Grouping fixtures

- **Daylight Harvesting** means each fixture is programmed to meet a certain light level. Adding photocells to fixtures allow them to account for natural light.
- **Occupancy Sensors** know when a space becomes occupied. These utilize motion and sound so lights remain on when people are moving or stationary in rooms and spaces.
- **High-End Trim and Low-End Trim** controls adjust light levels in individual fixtures. During retrofit projects the new lamps and fixtures are generally brighter than the equipment they've replaced. Trimming allows for the reduction of power usage while adding to the lifespan of the lamp. Low-end trim is choosing to lower the power sent to the lamp when a space is unoccupied. In some cases, this means shutting the fixture off.
- **Scheduling** is the ability to set times throughout the day or week for lights to turn on, off or adjust to chosen levels.
- **Grouping Fixtures** allows you to program groups of lights together depending on needed settings which may change over time and can therefore be regrouped.



LED lighting project types

Commercial and industrial companies who choose to install LED lighting can select from a few different project types. We outline the types below and reasons for each selection.

Exterior vs interior lighting + commercial vs residential

LED lighting projects can be segmented by type. Most energy professionals differentiate lighting projects as commercial/industrial or residential. Retrofits can be also designed for either exterior or interior applications, or both.

Many commercial and industrial building projects have both exterior and interior lighting that need an upgrade, and the same is true for residential projects. However, lighting types and project design are typically very different for commercial buildings versus a residential home for the following reasons:

- **Run hours can be much longer for commercial facilities, such as 24/7 manufacturing production**
- **Square footage is typically much larger for industrial campuses compared to somebody's home**
- **Controls installed for a project are often more sophisticated when taking entire facilities or multiple buildings into account versus a single home that may have a few sensors on exterior lighting**

While interior projects can deliver higher energy savings, many commercial/industrial operations teams start with an exterior LED lighting project. These projects usually lower required maintenance spend due to high replacement costs and accelerated degradation of high-intensity discharge lamps (HID.)

Energy savings are also available from upgrading exterior lighting, including parking lot pole heads, as well as wall packs and floodlights that illuminate pathways, loading docks or entrances. Two other benefits from improving exterior lighting are safety and security.



Retrofit projects with LED lighting

Many new construction projects choose LED lighting from the beginning. These facilities can select efficient fixtures as part of the overall design and incorporate modern lights while building out the rest of the structure.

However, existing facilities and legacy buildings typically need a retrofit project to upgrade from incandescent or fluorescent lighting to LED.

Retrofit LED lighting projects mean upgrading lighting design, replacing fixtures already in place and/or integrating new controls for a building's existing lighting system. Most retrofit projects designed to lower energy usage can often be qualified for utility incentives.

Defining turnkey projects

Turnkey efficiency projects are defined as energy upgrades designed by experienced engineers who consider each efficiency measure in the context of building operations. As part of a turnkey project, these engineers typically do three things:

- 1. Develop projects to achieve the best ROI possible**
- 2. Handle related permitting and paperwork**
- 3. Manage retrofits from inception to installation**

Many times, commercial or industrial corporations will include LED lighting as one of multiple efficiency measures in a larger energy project. Combining the benefits of a lighting upgrade with mechanical equipment retrofits or building automation integrations can deliver significant savings.

You can also tackle LED lighting as a stand-alone project, built to improve output and lower energy costs stemming from lighting infrastructure alone.

SIMPLE DEFINITION | Commercial & Industrial LED lighting

Commercial LED lighting installations mean upgrading, retrofitting or replacing existing lighting with modern LEDs. The efficient choice, new LED lighting can increase light levels, decrease energy use and lower operational costs.



Installing LED lighting in commercial facilities

Follow this six-step process for installing LED lighting in commercial or industrial facilities.

These steps outline the right way to select fixtures and leverage project management support. LED lighting projects should not only upgrade lighting appropriate for each building type, but also achieve a good Return On Investment.



Research



Partner



Audit



Monitor



Review



Reinvest

6 Recommended Steps for LED Lighting Installations in C&I Facilities

- 1. Research your options**, including vendors, lighting types, controls integrations and complimentary efficiency measures for turnkey projects.
- 2. Determine the right partner**; most large commercial/industrial companies should work with an Energy Service Company for the best results.
- 3. Audit the existing facility for lighting retrofit opportunities.** Some companies will perform these at no-cost.
- 4. Monitor project progress** which should include qualifying projects for utility incentives, scheduling around building demands, installing selected products and coordinating with relevant partners.
- 5. Review final lighting upgrade**, including lowered utility costs and any new controls capabilities.
- 6. Reinvest annual savings** from more efficient lighting into other business needs.



Aesthetics and lighting considerations for commercial buildings

When developing an energy conservation project, it's important to not only find solutions that are energy efficient and cost-effective, but that are also aesthetically pleasing.

Lighting color temperature plays a large role in the mood and emotional impact of a room or environment.

Think of spaces where you felt the lighting was stale or off-putting, and spaces where the lighting was so low it had a yellow glow to it.

While we often take lighting for granted, or just expect it to work, aesthetics have greater impact in some spaces compared to than others.

Examples include:

- **For a residential building with rental units and owned condos, having aesthetically pleasing lighting adds value to the property.**
- **Proper lighting in schools allows for greater comfort to occupants while learning.**
- **Even hospitals need brighter lights in their operating rooms than patient rooms.**

Every industry is going to have different requirements regarding aesthetics. However, lighting retrofits should all be tackled with an understanding of aesthetics as it relates to both color temperature and tone emitted from LEDs.



Color temperature

Color temperature falls on a scale that ranges from warm red colors to cool blue colors.

Color temperature is measured in Kelvin.

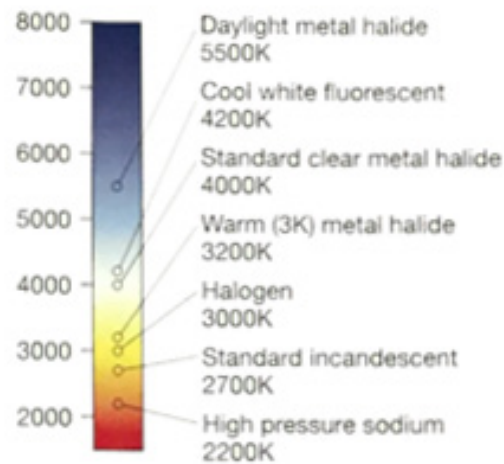
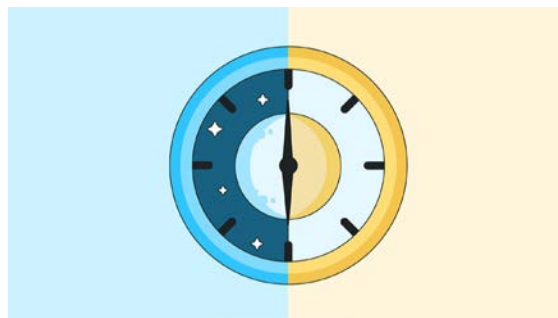


FIGURE 2.2 A kelvin scale illustrates that the warmer the apparent color of a light source, the lower the number of kelvins and a higher number on the scale represents a cooler or bluer color. Labeling includes typical color temperatures associated with daylight and selected lamps.

Circadian rhythm

Circadian rhythm is the term for daily human cycles because most people sleep at night and are awake during the day. The sun also has a daily cycle and can move through patterns of dimmer to brighter, and warmer to cooler color temperature. Controls give LEDs the ability to match these color temperatures.





Productivity

While aesthetic improvements and color variety are two leading advantages of LED lighting, researchers are starting to show improved productivity as a result of commercially installed LEDs as well.

Though their conclusions are still broad, some studies have pointed to the following three reasons LED lighting can improve employee productivity in the workplace:

1. LEDs emit less heat compared to other lighting types, lowering physical impact in a space with lots of lamps
2. Color temperature and controls, such as mimicking circadian rhythm, can be leveraged to improve working environments
3. Higher light levels with new LEDs can increase visibility for detailed work, such as in certain types of manufacturing facilities





LED Lighting by Industry

Every commercial industry has its own concerns and priorities for lighting. We've broken down each commercial industry's viewpoint on LEDs and some particular benefits or facts about lighting for each.



Biotech

LED lighting upgrades in biotech and pharmaceutical facilities can typically lower the lighting portion of an energy bill by 60-70%. Biotech operational staff will usually replace or retrofit LEDs in cleanrooms, stairwells, hallways, lobbies, laboratories, manufacturing space and other parts of pharmaceutical buildings.

Concerned with sensitive systems and quality environments for production, the biotech or pharma industries can integrate LED lighting with building or energy management systems for greater control. Setting specific color temperatures and leveraging the power of occupancy sensors are additional benefits of updating to LEDs with controls.



Data center

Although lighting is typically a small percentage of data center power demand, it's a system that can still lower overall energy use and improve operations when optimized. Adding LED fixtures with lighting sensors and grouping controls can help colocation facilities who bring new tenants in and out of a data center space. Integrating LED lighting into data center building management systems can also support better overall facility management.



Education

LED lighting and other efficiency projects can be one of the best investments for educational institutions, including colleges, universities and independent or private schools. Campuses have dozens of building types and lighting requirements, many of which benefit from occupancy sensors or other lighting controls.

LED lighting retrofits for colleges and universities, including classrooms, laboratories, dormitories, libraries, gyms or pools and other campus buildings, can usually lower operational costs for schools by about 20%.



Grocery & retail

Long run hours (resulting in high energy use) and poor, in-store visibility are two reasons grocery stores and retail establishments might consider an LED lighting project.

Three of the usual upgrades for grocery and retail LED lighting optimization are:

- **Parking lot/exterior upgrades**
- **Safety and visibility in warehouses or distribution spaces**
- **Occupancy sensors in places like freezers and aisles**

The grocery and retail industries tend to operate with thin margins, meaning lowered operational expenses can make a big difference financially.



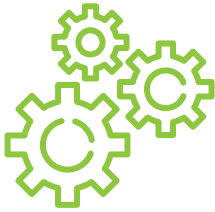
Healthcare

Healthcare and hospital lighting needs can range from operating rooms and hospital suites to local clinics and nurses' stations.

The patient experience is at the forefront of hospital and health facility lighting projects. But, engineers should also design retrofits to meet the needs of staff, visitors and facilities personnel.

Hospitals and healthcare facilities can save a significant amount of operating costs via LED lighting projects.

These facilities tend to have a large square footage across campus buildings and high run hours, in some cases, 24/7.



Manufacturing

Manufacturing facilities should upgrade lighting to LED for three primary reasons:

- **24/7 production or any long run hours mean significant energy and financial savings from retrofit projects**
- **Large facility square footage typically means high utility bills**
- **The safety and productivity of employees can improve with better visibility and higher light levels**

Because of manufacturing facility run hours and building size, LED lighting projects in this industry can often qualify for significant utility incentives. The right utility programs, relationships and project engineering can deliver incentive dollars that may cover 30-60% of project cost.



Property management

As a notable portion of a building's energy bill, lighting impacts a facility's value in two ways. One, inefficient lighting contributes to high operational expenses, decreasing value. But two, efficient lighting saves energy and can improve property value through an efficiency upgrade. Commercial LED lighting upgrades in the property management industry can include office buildings, parking garages or any property leased by a third party.

A room's lighting environment and the aesthetics of the fixtures are both considered while engineers design property management projects. Your energy service company or facilities team should be able to install LED lighting projects during off-hours or by working around the residents of an apartment or condominium building with minimal disruption.

Property managers who care about the energy efficiency of their properties will want to examine LED lighting as a potential solution.



Recreation & hospitality

Aesthetics are also key to LED lighting installations in recreational spaces and hospitality facilities, like hotels. These types of buildings are concerned with the guest or client experience.

The range of LED fixture types and smart-system integration, such as with Energy Management and Property Management Systems, offer hospitality and recreational facilities a lot of flexibility. **According to ENERGY STAR data from the U.S. government**, the average annual cost of a US hotel room's energy bill is over \$2,000 per year, so the savings associated with LEDs can significantly add up.



The Future for LED Lighting

Lighting is fundamental for every business and the benefits of LED lighting are undeniable. Commercial and industrial buildings can uncover significant annual savings through strategic LED lighting projects.

Technology improved throughout the mid-twentieth century and became more affordable during the 1980s and 1990s. Over time, a gradual switch from upgrading old fluorescents to more efficient ones turned into changing out CFLs to LEDs.

Lighting systems engineered for efficiency and savings are an invaluable operational opportunity for commercial companies. We recommend most LED lighting installations or upgrades to include some degree of controls as well. Combining granular control with aesthetic and practical benefits not only improves overall efficiency but day-to-day lighting system use.

Managing smart LED lighting systems is a tactic every building owner should know about, and every operations team should be taking advantage of.





What's next?

Congratulations!

You now know A LOT about LED lighting in commercial and industrial spaces.

Don't forget:

- **Lighting upgrades lower energy use and operational expenses across industries**
- **LED lighting technology continues to advance**
- **You don't have to tackle optimization projects alone**
- **Now is the time to benefit from lighting efficiency solutions**

Want to learn more?

This is just one of the resources by Mantis Innovation tackling questions about upgrading and retrofitting buildings to meet maximum efficiency abilities. We recommend checking out our blog full of information.

We cover topics like:

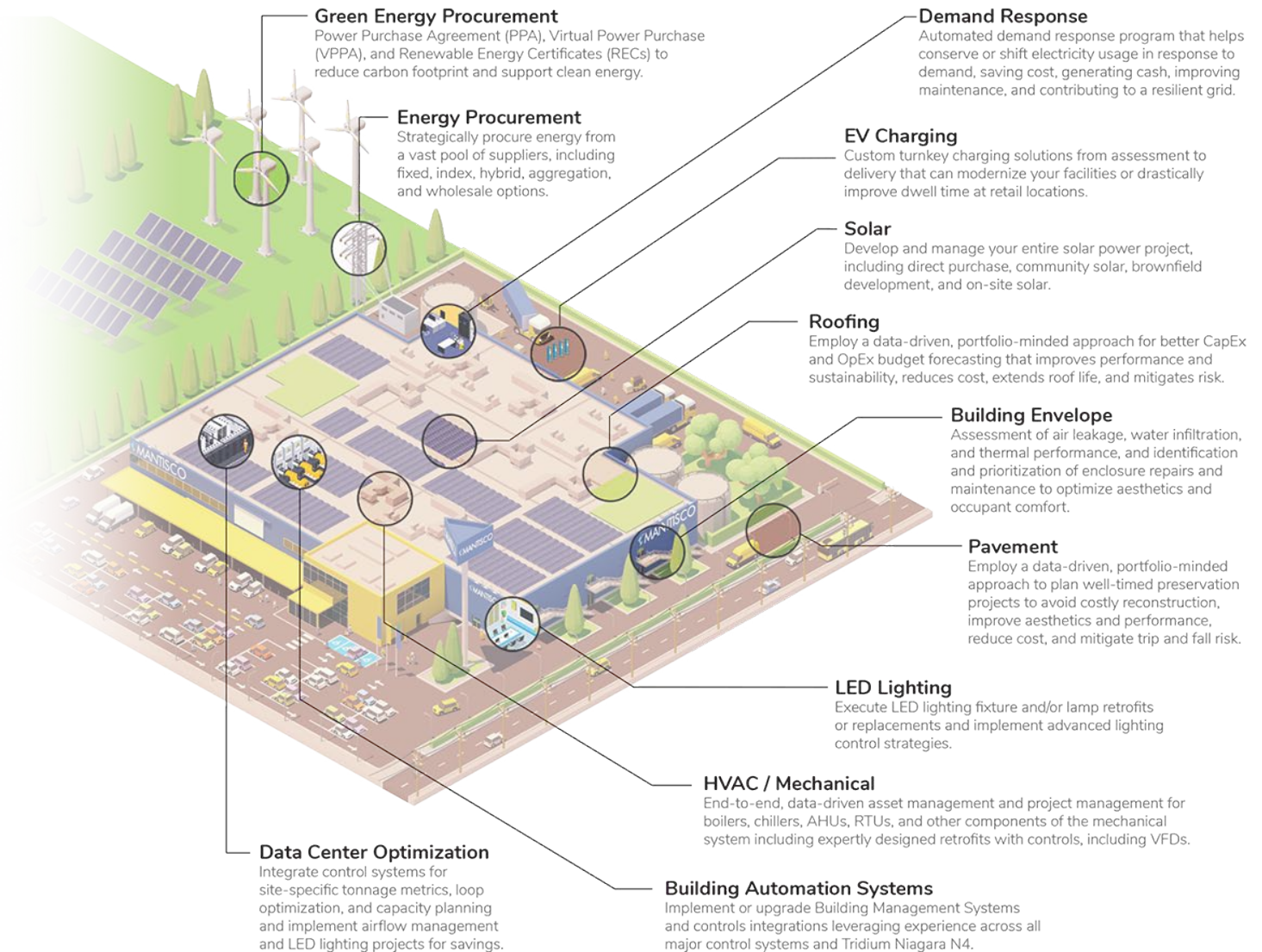
- **Data center optimization**
- **Building Management and Automation Systems**
- **HVAC and mechanical solutions**
- **Industry events**
- **Equipment solutions**
- **And many more!**

[Discover many more sustainability topics »](#)

About Mantis Innovation

Mantis Innovation delivers smart facility solutions to improve financial and sustainability performance. We provide managed facility services and turnkey program management with technology-enabled solutions that target the entire building footprint, both outside and in. Our company is organized by practice areas of: **energy management, facility management, procurement, and sustainability consulting.**

Every day, we solve challenges with data collection, technology integration, and analysis to enable better decision-making at the portfolio and site levels. As an independent consultant, and project and program manager, we are uniquely able to provide visibility across your portfolio and bridge gaps between on-site management and the C-suite.





Contact us and let's reimagine your facility sustainability



Mike Bendewald
Vice President, Sustainability Solutions
mbendewald@mantisinnovation.com



Rob Golden
President, Efficiency Solutions
rgolden@mantisinnovation.com

For general inquiries email info@mantisinnovation.com