

# LED lighting retrofits

## Long lasting, highly efficient lighting upgrades that enhance building performance and occupant well-being.

tech overview

applicable building types  
all buildings

when to implement  
anytime

fast facts

- reduces GHG emissions
- improves light quality
- extends lifespan of bulbs and equipment
- increases utility savings
- reduces maintenance costs

costs & benefits\*

GHG Savings



Tenant Experience Improvements



Utility Savings



Capital Costs



Maintenance Requirements



\*ratings are based on system end use, see back cover for details.



## getting to know LED lighting

LED lighting upgrades are a low-cost, high impact opportunity to improve the performance of a building's lighting system, reduce energy use, enhance occupant comfort, and save money.

### how do LED lights work?

Light-Emitting Diodes (LEDs) are a long lasting and compact type of light source that uses efficient technology to emit light in a specific direction, reducing the need for reflectors and diffusers while generating very little waste heat. LEDs have several advantages over traditional incandescent and fluorescent lighting, including greater energy savings, longer lifespans, greater durability, and equal or greater light quality and color range.

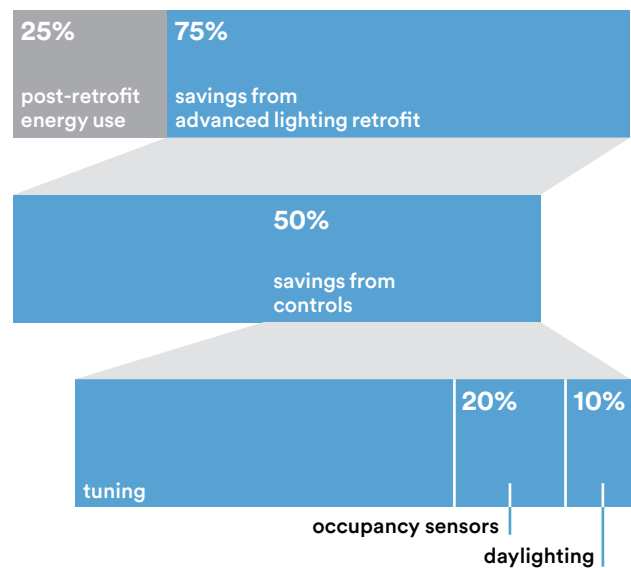
A high performance LED lighting upgrade is among the most cost-effective means for building owners to lower their energy use, cut operating costs, and reduce their carbon footprints. LED upgrades also enhance lighting quality and aesthetics, which can improve occupant well-being and increase property values and rents.

LED upgrades can be completed at varying levels of complexity and cost, from replacing individual components (such as lamps, ballasts, and sensors), to relighting or redesigning entire spaces. Typically, the more comprehensive the retrofit, the greater the improvements to comfort, aesthetics, functionality, and payback.

LED lighting upgrades typically require close collaboration between the building owner, lighting

designer, distributor, and contractor. Project teams should identify the technologies and functions that best meet their specific needs. Educating building occupants is also crucial to project success.

Fig 1. Upgrading to more efficient fixtures and installing advanced controls can reduce lighting electricity use by as much as 75%. Individual project savings will vary depending on the scope of work and baseline conditions. (Source: BE-Ex analysis, 2017.)



#### Assess

Always consult a qualified service provider before undertaking any building upgrades.

#### Educate Stakeholders

Close cooperation with building occupants is key to project success. Maintenance personnel, facility managers, and occupants themselves must be involved in the process and educated on system operation.

*Engaging end-users throughout the process reduces misunderstandings that can derail projects, ensures a smooth transition, and creates project advocates.*

#### Install & Commission

It is crucial for a project manager to oversee the installation process and ensure that systems are properly commissioned prior to full operation. Commissioning by a trained professional will ensure that the system is performing effectively, and that occupants are comfortable.

*Systems should be periodically monitored, tuned, and maintained to ensure that they continue to function correctly.*

## how to upgrade to LED lighting

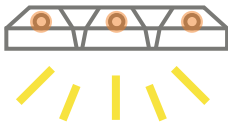
Lighting upgrades can vary considerably in complexity and cost. Understanding the process, players, and goals at the beginning of a retrofit can make the project easier and more successful.

### retrofit solutions

Advanced lighting retrofits may include some or all of the following activities:

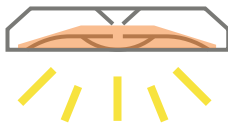
**A Upgrade Lamps and Fixtures:** Incorporating higher efficiency lamps (the components of a light fixture that emits light) and/or entire fixtures can result in significant savings. There are several ways to incorporate LEDs into an existing space:

**1. Lamp and Ballast Replacement:** Replacing lamps while keeping existing fixtures is an uncomplicated and affordable upgrade option. Ballasts (a device that controls the voltage and electric current in fluorescent lighting) may require replacement depending on compatibility with new lamps.



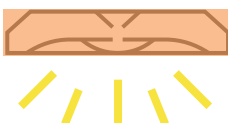
- Low initial cost
- Existing optics
- Existing appearance
- Lighting varies

**2. Fixture Retrofit:** Modifying existing fixtures, in addition to installing LED lamps, can yield further improvements. The existing housing can remain in place, while the interior of the fixture is reconfigured with an LED array and improved optics, typically sold as a kit.



- Moderate cost
- New optics
- New appearance
- Same size/location of light

**3. Fixture Replacement:** Replace the fixture entirely for best performance, improved optics, significant energy savings, and an updated aesthetic. This option easily integrates with controls and building systems.



- Highest cost
- New optics
- New appearance
- Flexible type/size/location

**B Install Advanced Controls and Sensors:** A lighting control system ensures functionality and integration. Control systems feature myriad options, including real-time scheduling, occupancy and daylight response, task-tuning and color-tuning.

- Occupancy sensors automatically dim or turn off lights when a space is unoccupied after a programmed amount of time. Vacancy sensors further increase control by requiring lights to be turned on manually.
- Commercial lighting systems should be integrated with a wireless control system that connects all fixtures to a global control station for integrated programming. The control station can program all applicable lights to turn off during unoccupied periods, create override options, and program dimmable fixtures to match lighting levels to ambient lighting needs.
- The control station can be tied to utility demand management programs to reduce lighting during periods of high regional electricity demand.

**C Incorporate Daylighting:** Daylighting systems use photosensors to monitor interior lighting levels and controls to reduce electric lighting in proportion to available daylight. Automated shades can be integrated into the system, providing maximum comfortable daylight and views to the outdoors while minimizing glare, decreasing cooling loads, and saving energy.

**D Incorporate Interior Design:** Interior design decisions have a tremendous influence on lighting efficiency, both in terms of cost and energy usage. Planning smart interior layouts with low-cost, passive design solutions can improve energy savings and enhance occupant comfort.

- Daylighting, open-plan office arrangements with low desk partitions, strategic furniture placement, and light colored paint can reduce the need for electric lighting by increasing ambient light in the space.

## costs & benefits of LED lights\*

### Greenhouse Gas (GHG) Savings



An LED lighting retrofit can greatly reduce lighting related GHG emissions, however specific savings will be dependent on pre-retrofit conditions and other building systems.

### Tenant Experience Improvements



High quality lighting can positively influence occupant comfort and satisfaction. LED lighting has excellent lighting characteristics, offering a broad range of colors and color rendering capability (a light source's ability to reveal true colors of objects). These qualities make LEDs suitable for any space or application, offering a range of aesthetic options that can increase property values and rents.

### Utility Savings



LED lighting uses significantly less energy than incandescent or fluorescent bulbs, resulting in dramatic utility savings.

### Capital Costs



LED lighting retrofits requires a relatively low capital investment, although costs can vary greatly depending on project scope, degree of disruption, and market forces.

### Maintenance Requirements



LED lights require a low level of maintenance. LED lamps have a long lifespan and are easy to dispose of because they do not contain any of the hazardous heavy metals found in fluorescent lamps. Any re-wiring work that is done should be performed by a trained electrician.

*\*The Costs & Benefits rating system is based on a qualitative 1 to 4 scale where 1 (lowest) is lowest and 4 (highest) is highest. Green correlates to savings and improvements, orange correlates to costs and requirements. Ratings are determined by industry experts and calculated relative to the system end use, not the whole building.*

Note: Assumes mixture of fluorescent and incandescent lighting with no controls.

### take action

This document is one of more than a dozen High Performance Technology Primers prepared by Building Energy Exchange and its partners to introduce decision-makers to solutions that can help them save energy and improve comfort in their buildings. Access the complete Tech Primer library: [be-exkc.org/techprimers](http://be-exkc.org/techprimers)

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