



Commercial Lighting Renovation Guide

How to confidently select your lighting contractor, select products and maximize lighting efficiency in your facility.

Unless your lighting system is just a few years old and was designed with the specific intent of maximizing energy efficiency, you have the potential to save energy while making your facility more profitable. The process of beginning an energy efficiency lighting upgrade can be intimidating – from deciding where to start, how to select the proper contractor, product specifications, potential lighting systems, light levels and rebates.

The purpose of this discussion guide is to help you, the buyer, through the process of a lighting equipment upgrade. Each lighting upgrade is individual to a specific building and particular project; there are no universal rules that apply to every project. Lighting renovation projects are usually designed based on the goals of the customer. The best plan is to discuss your needs with a chosen energy renovation professional(s) and create a unique plan to meet your goals.

Ultimately, we all want comfort and efficiency while getting the most for our money. This is why we, as consumers, must be educated - knowing where to begin is both important and empowering.

SRP Business Solutions

SRP supports energy efficiency through lighting upgrades with direct rebates for retail, commercial and industrial accounts.

SRP Rebates

\$0.30 cents for every watt of demand reduced for interior LED and \$0.20 cents for exterior retrofit and new construction LED Lighting.

HOW DO I SELECT A CONTRACTOR?

1. Make a list

- Ask business associates, family and friends for referrals
- Check the SRP webpage for a list of SRP Alliance members at:
<http://savewithsrpbiz.com/rebates/contractor.aspx>
 - Or you can send an email inquiring about SRP Alliance member to:
savewithsrpbiz@srpnet.com
- Check out the BBB listings for companies in your area
- Check out local “Best Of..” award winners

2. Research (via Internet or telephone calls)

Narrow the pool of contractors to assess your system and building needs down to a group of three to five options. Sample qualifications you could use to narrow the contractor pool:

- How long has the company been in business?
- What licenses does the company hold? (Mechanical and electrical licenses are frequently needed for installation of new equipment or for major repairs)
- Is the company a member of the National Association of Lighting Management Companies (NALMCO)

- Does the sales representative hold any certifications: Certified Energy Manager (CEM), Certified Lighting Energy Professional (CLEP), Lighting Certified (LC).
- Verify general liability insurance and worker's compensation coverage.
- Verify that the business is registered with the state and local authorities.
- Will the company provide references of former customers that you could speak with?
- What is the warranty on installation and material? How will it be handled?

3. Schedule an appointment or assessment

An experienced contractor will have the knowledge necessary to diagnose and determine the correct course of action when inspecting existing an lighting system. Items that are typically investigated by the contractor during the assessment:

- Detailed count of each lighting fixture
- Reading existing light levels with a foot-candle meter
- Identify each type of existing lamp and wattage (Be prepared to provide this info to the contractor)
- Can you, as a customer, provide original architectural drawings of the facility?

4. Lighting Design from a Manufacturer's Representative Agency

If your desire is an "apples to apples" quote from multiple contractors, look to a local lighting manufacturer's representative agency. The rep agency will clarify your goals in lighting and create a design to achieve those goals. You will then have a single set of specifications by which to go to bid. In most cases, the agency will not charge for this service, since their product will be specified

5. Contractor Proposal

The contractor or distributor should provide a written proposal with the following:

- Detailed description of the work to take place
- Counts of what is to be removed, retrofitted and installed
- Change order process of any unforeseen needed electrical wiring and equipment
- Cost to remove and recycle or dispose of hazardous waste lamps and PCB contaminated ballasts. (Required by SRP)
- Total cost, either broken out or turnkey, inclusive of Labor, material and tax.
- Permit fees
- Installation schedule
- Payment schedule

6. Compare Estimates

It is comfortable to pick the estimate that is in the middle of the pack. However, consider the following:

- If a bid stands out as substantially higher than the others, ask the contractor. They may have identified something that the other companies missed.
- A low bid should be scrutinized for what was omitted compared to the other bids
- Compare options, efficiency standards
- Compare guarantees / warrentees
- Be wary of the company that wants cash only, or payment in part or in full up front

7. Should I negotiate price?

It is difficult to purchase anything without asking or negotiating the price. A negotiation involves trade-offs. Following is a list of items to prepare for in the event this path is taken.

- Check the fine print to ensure equipment disposal does not shift to you. Fluorescent lamps contain trace amounts of mercury and must be disposed of according to the EPA guidelines
- Be prepared to compare all aspects of the bid without overlooking the miscellaneous costs.
- Does the bid include a warranty period for equipment failure or a service agreement? This may be taken away during price negotiation.

WHAT SHOULD I BE THINKING ABOUT AS I MOVE FORWARD?

Listed below are several questions for you to consider discussing with your maintenance staff, property management firm, building engineer, and contractor.

“What is my current lighting system and what, if any, are its deficiencies?”

The contractor / lighting professional should give you a clear explanation of your existing technology and improvements in lighting that have taken place.

“How do I know how much light I have?”

The output of a light source is rated in “lumens”. The light that is measured falling on the work surface is measured in foot-candles. Light level readings are measured at 30” above the floor, which is the standard desk height. If your work plane is higher or lower than 30”, this should be reviewed with your contractor / lighting professional and planned for during the equipment upgrade.

You should expect that a contractor / lighting professional should be able to read your existing light levels with a foot-candle meter. The next section will help you get more comfortable with looking at foot candle readings with the contractor / lighting professional to understand your existing light levels.

“How much light do I need?”

This is a great question. There is an international professional organization—The Illuminating Engineering Society (IES)—that has been studying lighting for over a century, and they have established recommended light levels for numerous applications. Light level recommendations from IES are generally adopted into the national building code. It’s best to check with your contractor and the local municipality for applicable codes and standards. The IES recommended levels can be found at www.ies.org.

“How much light do I want?”

As you make decisions to replace your equipment, it is up to you to decide whether the existing system you are replacing contains too much, too little, or the perfect amount of light for your space. Your contractor can guide you through the different types of lighting technology available that can best meet the needs of your business.

“Are there general light fixture types that are more common in certain applications?”

Absolutely. In general, whether it is an industrial, office or retail space, metal halide and high pressure sodium lighting technologies have been surpassed by fluorescent T8, T5 and LED technologies. These products maintain higher light levels over longer periods of time, have longer rated lives, and have the ability to incorporate controls to turn off the lights during periods of low to no occupancy. Dimming controls can be integrated to take advantage of daylight harvesting from windows and skylights.

The following table includes some common applications of equipment – it is intended to serve as a guide. Consult with your contractor /lighting professional to address your specific needs.

Industrial Spaces	Office or Retail Spaces
T8 fluorescent fixtures in an open warehouse or industrial environment are best mounted below 17-20'. Above a 20' mounting height, T8 lamps may not effectively deliver light on the work plane. Note that T8 lamps are not the proper selection for a cold (refrigerated) environment.	T8 fluorescent lamps paired with electronic ballasts are highly cost effective for energy efficiency, especially when compared against T12. Even if your facility has existing T8 technology, new equipment is far more efficient than the first generation of T8 technology.
T5 fluorescent lamps are best when mounted over 20' high. T5 lamps used as replacements in existing fixtures mounted below 20' have a tendency to cause glare.	T5 fluorescent lamps are best installed in indirect fixtures at mounting heights under 12'. While T5 lamps are more efficient than T8 lamps, it can be difficult to justify the higher cost versus efficiency increase. T5 lamps used as replacements in this scenario have a tendency to cause glare.
LED fixtures are popular in open industrial spaces. Like T5 lamps, LED replacement lamps and fixtures can cause glare, unless the diodes are properly shielded / lensed.	New LED fixtures offer better lighting distribution and control potential than replacement tubes. LED tube technology can be retrofitted into existing fixtures—see next two sections for more detail. For anything other than indirect lighting, make sure the diodes are lensed.

“I have heard that existing fluorescent fixtures can be retrofitted. What does this mean?”

Basically, that the existing lamps and ballasts are replaced while the metal fixture housing is kept intact. It is the lamp (selected in lumens of light output) paired with a specific ballast that determines the actual light output of the total fixture. This is true for both existing and proposed lighting.



Think of the lamp and ballast combination as similar to a manual transmission in a car. The car will only drive so fast in first gear, second gear, and so on. To increase speed, shifting gears is required. And the faster you travel, the more gas (or energy) is consumed.

A fluorescent lamp, like the engine, has a rated output. The ballast determines the actual output of the lamp and the energy consumed, similar to the gears in a car determining the speed of the vehicle and the miles per gallon efficiency.

A ballast with a low ballast factor (BF) drives the lamp to deliver less light output than it is rated for – like first gear. Lower light output also corresponds to less energy consumed. A ballast with a standard (BF) combined with the same lamp produces greater light output. At the same time, the energy consumed is greater - second gear. There are ballasts with high BF ratings. This ballast in combination with the same lamp will provide the greatest light output from the lamp, and consume the most energy of the three scenarios.

Following is a technical illustration of this point.

Existing Equipment:

- F32T8/741 lamp at 2,850 lumens x .88 ballast factor = 2,508 actual lumens per lamp
- 2,508 lumens/lamp x 4 lamps = 10,032 total fixture lumens, existing equipment
- Note: The power consumption of this fixture is 112 watts

Replacement Option 1: (this is one of many replacement options)

- F25T8/841 lamp at 2,500 lumens x .78 ballast factor = 1,950 actual lumens per lamp
- 1,950 lumens/lamp x 4 lamps = 7,800 fixture lumens, new equipment
- Note: The power consumption of this fixture is 76 watts

Replacement Option 2: (this is one of many replacement options)

- F28T8/841 lamp at 2,725 lumens x .78 ballast factor = 2,125 actual lumens per lamp
- 2,125 lumens/lamp x 4 lamps = 8,502 fixture lumens, new equipment
- Note: The power consumption of this fixture is 87 watts

Difference between Existing and Replacement Equipment Options:

- Option 1: There is 32% less light delivered to the space; with a 30% decrease in energy consumption
- Option 2: There is 15% less light delivered to the space; with a 22% decrease in energy consumption



- Learn how much light you have
- Determine whether the level of light is just right, or if you want more or less
- Understand what you gain or lose with the retrofits being considered

LED tubes are rated with their lumen output. Just as with fluorescent, it's important to understand the relationship between the rated lumens of a direct replacement Type A, "plug & play" tube and how the ballast factor effects that lumen output.

"Are LED T8 tubes an easy one-for-one upgrade to LED technology?"

They can be. Below are three different approaches to installing LED tubes in place of standard fluorescent lamps. Just like any other LED product, it must be DLC and/or Energy Star rated to be eligible for program rebates.

PLUG AND PLAY RETROFIT

Plug and play lamps have been designed to be a one-for-one replacement with existing T8 fluorescent lamps. The power is turned off, the old lamp is removed, the new LED lamp is installed, power is restored, and the new lamps operate.

It is recommended that business owners evaluate the age of the existing ballast, as well as the number of hours it has operated. If more than half of the ballast life has passed, consider upgrading and replacing the existing ballast.

Most manufacturers publish a Ballast Compatibility Guide that identifies LED lamps paired with existing ballasts that have been tested and are approved.

Advantages:

- ✓ Quick and easy retrofit
- ✓ Minimal disruption to workspace
- ✓ 50,000 hours life

Disadvantages:

- Life expectancy of existing fluorescent ballast unknown
- Not all ballasts and replacement LED lamps are compatible
- Lumen output of LED is affected by the existing ballast factor
- Non-dimmable
- No IoT connection

BALLAST BY-PASS RETROFIT^{1, 2}

The replacement LED lamp is line voltage rated. This means that contractor will remove the ballast from the circuit and the line voltage, 120 Volts or 277 Volts, will be wired directly to the sockets that hold the lamps in place. Sockets can be shunted or non-shunted, single or double ended wiring based on the initial fixture configuration.

Once a ballast is by-passed, a standard fluorescent lamp cannot be plugged back into the socket as they are not rated for line voltage.

Advantages:

- ✓ Less expensive

Disadvantages:

- Work should be performed by a qualified electrician
Labor can offset lower price of materials
- Line voltage to the socket may pose a future safety risk
- Non-dimmable
- No IoT connection
- **Only Dual Ended wiring eligible for a rebate**

LAMP AND DRIVER RETROFIT¹

The replacement LED lamps will either have a driver internal to the lamp (plug-and-play), or the electrician will mount a new driver in or on the fixture to replace the old ballast.

Advantage:

- ✓ Preferred when advanced control is required (dimming, etc.)
- ✓ Certainty of 70,000 + hour life of lamps & driver
- ✓ Low amps delivered to sockets (safety)
- ✓ Dimmable
- ✓ IoT compatible

Disadvantage:

- Work should be performed by a qualified electrician
- Must purchase the LED driver / transformer (must be hard wired to line voltage)

LED KIT vs NEW INSTALLED FIXTURE

If you decide the existing fixture is not the right product to achieve your lighting goals, you have the (2) options: Gutting the existing fixture and installing an LED kit, or replacing the fixture with a new fixture.

Kit:

- ✓ Must be "UL Kit" rated or the fixture loses it's UL Rating
- ✓ Each fixture style must be measured for compatibility
- ✓ Is the kit dimmable?
- ✓ Rated hours on LED's and driver?
- ✓ IoT compatible?
- ✓ Controls?

New Fixture:

- ✓ UL Rated
- ✓ Is the fixture dimmable?
- ✓ Rated hours on LED's and driver?
- ✓ IoT compatible?
- ✓ Controls?

¹When choosing these specific LED replacements for T8 lamps, the manufacturer provides the contractor with a sticker that is to be mounted inside the fixture. The sticker alerts maintenance and/or contracting staff that the fixture has been electrically modified from its original design to accommodate LED lamps.

²When a fixture is re-wired from its original intended design, such as bypassing a ballast and putting line voltage to the sockets, you may be negating the fixture UL rating. Please work with your contractor to ensure that the replacement equipment has been UL approved in combination for this type of application.

Power Over Ethernet

LED's are low voltage DC devices. Most LED product has a driver, which is an AC to DC low voltage convertor. The conversion from AC to DC at each fixture is inefficient and wastes power over the entire system. Power Over Ethernet, (PoE) is a system by which incoming power to the building is routed through a single AC to DC convertor. Low voltage power is transmitted over Ethernet cables to operate the luminaires, while high volumes of data are sent and collected. The collection of data is customized to the individual fixture (space) because each fixture is its own IP address.



What are the benefits of PoE lighting?

The data collected can include occupancy, so that control schedules can be customized by area. Ambient light levels recorded, so that daylight harvesting can be maximized. Individual fixtures can be customized for light level and color by the person sitting under the fixture through the use of a smart phone. Management is immediately made aware of maintenance issues through IoT

reporting. Since the lighting is DC powered, battery back-up at the main convertor is effective in case of power outages.

“If my lighting equipment upgrade includes a lamp and ballast change out, will the contractor provide a post light level reading to verify lighting goals?”

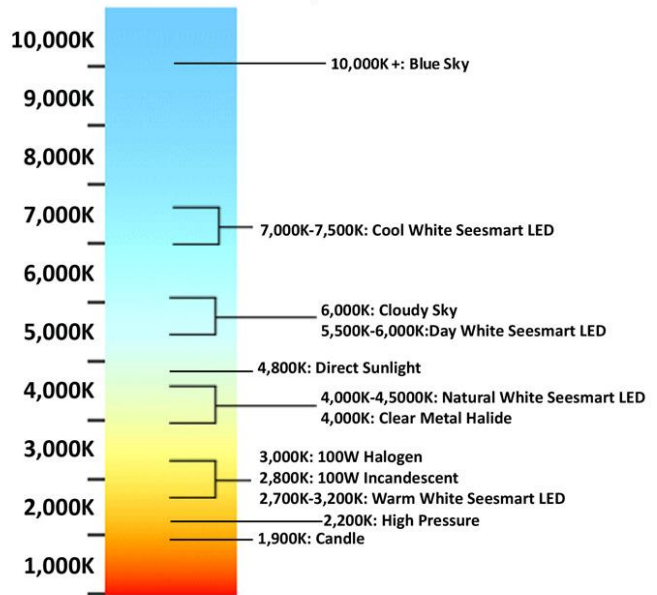
Ask the contractor to measure light levels in the same spots both before and after the lighting upgrade. Make sure you receive the light levels you planned on. This is a simple step to ensure that your goals are achieved.

“Is color important to me?”

That really depends on what you are doing within the space. Lighting products produce various ranges of color, and that determines how surfaces and product look.

The color of light is represented in Kelvin Color Temperature, “K”. The lower the color temperature the richer or more red is in the color. A true white color is around the 4,000 to 4,100 K temperature. Work with your contractor to select the color most appropriate to your application.

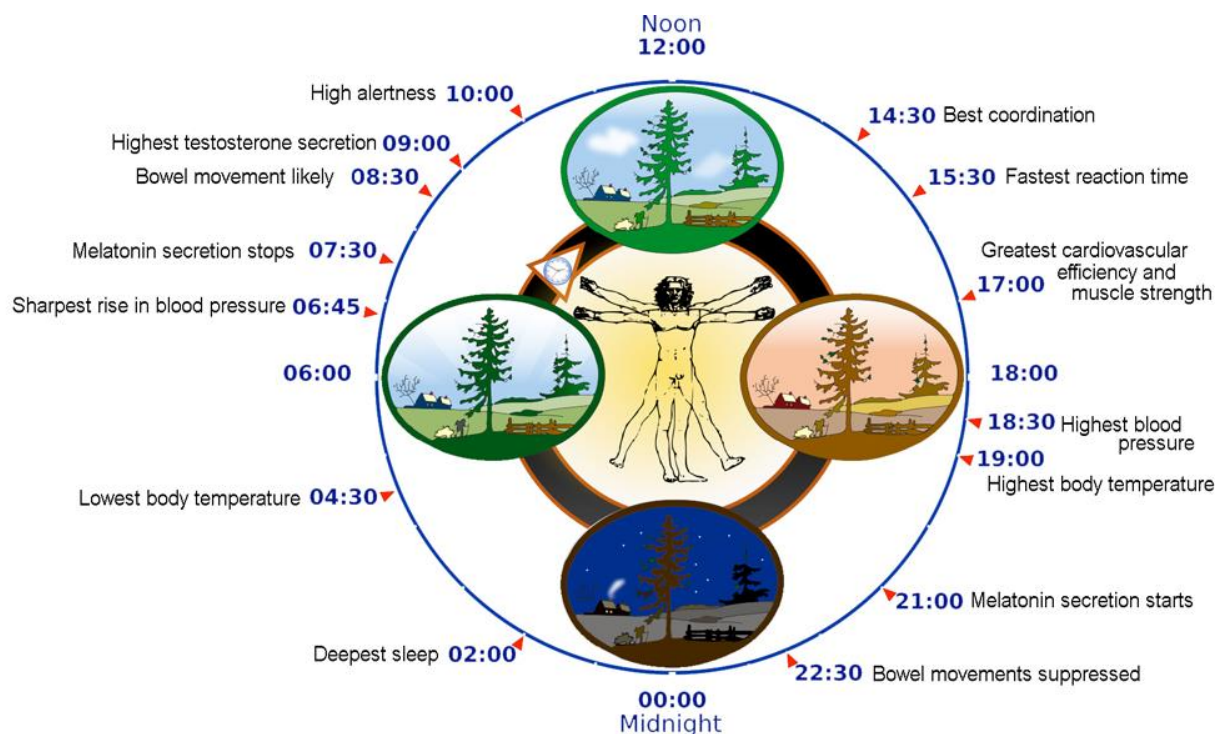
Kelvin Color Temperature Scale



Some LED lighting manufacturers attempt to achieve the highest light output (lumens) possible by narrowing the light wavelength to higher Kelvin, 5K or higher. It’s important to understand what that color light will look like in your facility and the impact it may have.

Circadian Rhythm

Circadian Rhythm is the body’s reaction to the color of light. The human body is on a rhythmic cycle and the color of light plays a vital roll in that cycle. Circadian Lighting follow the color of the sun putting the body in a natural rhythm. New fixtures and Type C tube retrofits may have this option.



Circadian Rhythm Benefits

- Increased alertness in the morning
- Productivity and concentration improvements
- Improved mood
- Reduced hyperactivity
- Reduction in errors and accidents
- Faster cognitive processing
- Improved sleep

“What is a photometric drawing and is it applicable to my business?”

A photometric drawing is a representation of the light you will receive on the work plane. The drawing will show the location of the fixtures and a grid pattern of numbers. Each number will represent the foot-candles at that spot on the work plane. A photometric drawing will provide the average overall foot-candle levels and the average to minimum foot-candle levels. The average to minimum value represents the spread between dark to light areas. The closer the ratio is to 1:1, the more uniform the light. A ratio of 3:1 or higher represents bright and dark spots versus uniform lighting levels.

“How are motion sensors and other lighting controls applicable to my business?”



Lighting controls represent the next step in energy savings after changing to more efficient lighting sources. There are numerous options when it comes to controls.

The most basic control turns lights off when they are not in use. Both fluorescent and LED technology can incorporate dimming, which also offers additional savings opportunities. Dimming takes advantage of low occupancy periods, as well as accounting for the natural light added to a space when skylights or windows are present.

SRP Control and Sensor Rebates

SRP supports controls with up to \$.17 cents per watt controlled, and Building automation systems may also qualify under the Custom program at up to \$.15 cents per sq ft.

Building automation takes dimming and occupancy controls to the next level. Via a computer program, a building automation system allows you to schedule on and off periods for all lighting fixtures. For example, an ‘off’ period could be scheduled for every day at 10 PM – ensuring that all lights are off when the building is not in use, saving energy dollars. Controls can range from \$.35 to \$.55 per square foot to install, and they can offer a great return on your investment (ROI).

“Will the contractor fill out and submit the SRP rebate application on my behalf?”

Discuss the SRP rebate application and submittal process with the contractor so there is no confusion about who is handling the SRP rebate application and seeing it through to completion.

You can either submit the application yourself, or have the contractor submit on your behalf. The rebate can be paid to the SRP account holder or to the contractor who can reduce his quote by that amount. The choice is yours.

Always remember, you have the control over the power your facility consumes. Use it wisely and the end result will be saved energy and therefore, a more profitable facility.

NEXT STEPS

Now that you are armed with the necessary information to confidently select your lighting professional / contractor and begin the process of upgrading your equipment, you can rest easy knowing that your research has put you in a good position to control the process and achieve maximum lighting quality and efficiency.

Want more information on rebates that are available?

<http://www.srpnet.com/menu/savingsbiz/default.aspx>

+1 602 236 8833

SRP BUSINESS SOLUTIONS

SRP is committed to helping you save energy and money. We offer a rebate program for every size and type of business.

- **Standard Business Solutions**
- **Small Business Solutions**
- **Custom Business Solutions**

Find out which rebate programs are for you:

- **Savewithsrpbiz.com**
- **Program administrator, (602) 236-3054**