STOUCH LIGHTING®
LED LIGHTING SOLUTIONS

Lighting Comparison

LED vs. Traditional Lighting

www.stouchlighting.com

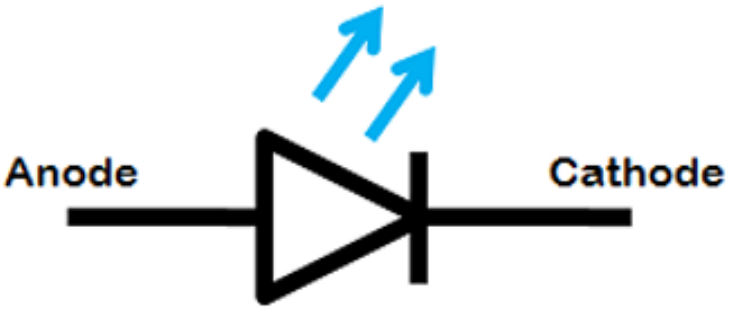
More than ever before, facility managers, building owners, companies, and communities are making the switch to LED lighting over conventional lighting products.

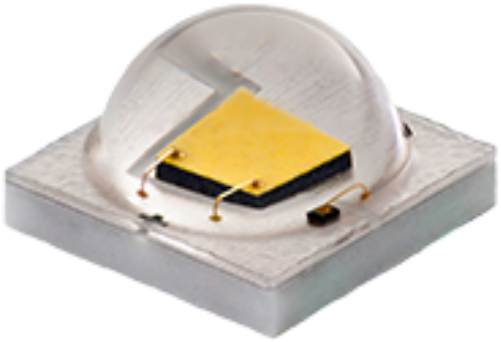
The energy, maintenance, and performance benefits of LED lighting are clear, but what isn't always clear is how these benefits stack up versus the status quo.

In this e-book we'll explore the advantages of LED and how it compares to various conventional lighting applications.

What is a Light Emitting Diode (LED):

LED stands for Light Emitting Diode. A diode is an electrical device or component with two electrodes (an anode and a cathode) through which electricity flows - characteristically in only one direction (in through the anode and out through the cathode). Diodes are commonly made from semi-conductive materials such as silicon or selenium; solid state substances that conduct electricity in some circumstances and not in others (e.g. at certain voltages, current levels, or light intensities). When current passes through the semiconductor material the device emits visible light.





What's The Upside to LED Lights?

Energy Savings

- LEDs are extremely energy efficient compared to every other available commercial lighting technology. They waste very little energy in the form of heat. Additionally, they emit light directionally over 180 degrees instead of 360 degrees which means there are far less light lost from the need to redirect or reflect light.

Maintenance Reduction

- LEDs have a very long lifespan relative to every other lighting technology, thus reducing the amount of time and money spent replacing bulbs. LED lamps and fixtures can last 50,000 to 200,000 hours or more.

Lighting Performance

- LEDs are available in a wide range of **color temperatures (CCT)** that generally span from 2200K-6000K or from "warm" yellow to light or "cool" blue.
- LEDs provide a very broad spectrum of **Color Rendering Index (CRI)** values is ranging generally from 65-95.
- Directional: LEDs are naturally directional (they emit light for 180 degrees by default).
- LEDs can be dimmed and are "instant-on."

Throughout the course of this e-book we'll be examining the primary differences between LED Lighting and traditional lighting of the past.

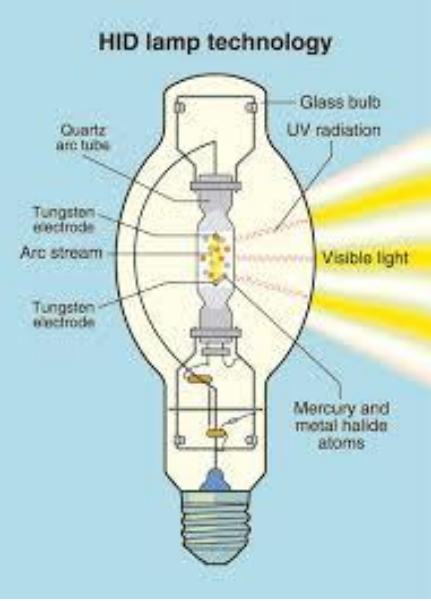
High Intensity Discharge:

High Intensity Discharge (HID) is an overarching term for a gas-discharge light. Among the common types of HID lamps are **Metal Halide (MH)**, **Low and High Pressure Sodium (LPS & HPS)** and **Mercury Vapor (MV)**.

- HID lamps produce light by sending an electrical charge or "arc" between two tungsten electrical conductors (electrodes) and through an ionized gas (also known as "plasma") which is housed inside the bulb.

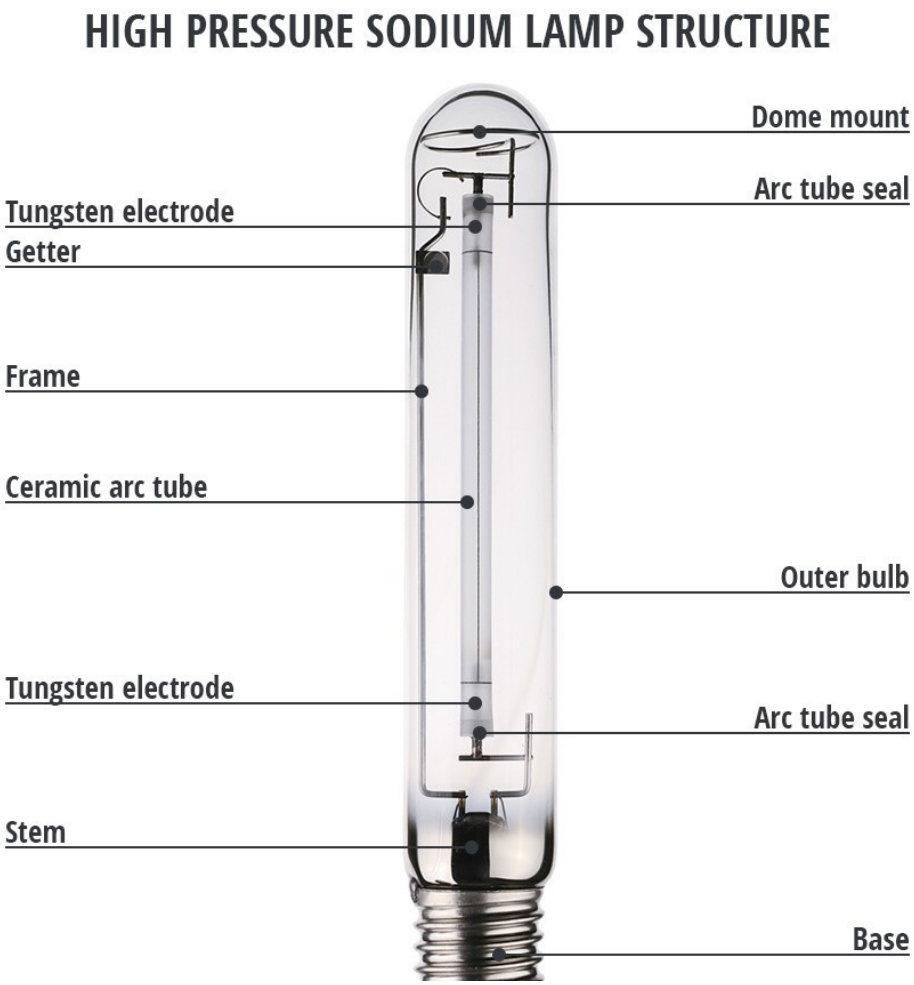
- Once lit the electrical arc begins to evaporate the metal salts inside the bulb which significantly increases the luminous power of the bulb while simultaneously improving lighting efficiency.

HID lighting requires a "warm-up" period because the lighting intensity is dependent on and changes as the material inside the bulb is evaporated into plasma. HID lights become less and less efficient over time because they must use more and more voltage to produce the same lumen output as the light degrades.



High Pressure Sodium (HPS) and Low Pressure Sodium (LPS)

HPS and LPS lamps are a specific type of HID lighting. The principal difference between low and high pressure sodium lights is the operating pressure inside the lamp. As indicated by the name, “high” pressure sodium vapor lights operate at a higher internal pressure. The arc tube is made of aluminum oxide and the sodium metal is combined with several other elements like Mercury which counter-balances the yellow glow with some white to light blue emissions. HPS is far more common than LPS.



Tell me about High Pressure Sodium…

Sodium vapor lighting has been in commercial production since the 1930s and was a relatively effective way to provide lighting over a large area. Sodium vapor lights have the worst color rendering (CRI) on the market.

- Sodium vapor lamps require a warm-up period when turned on.
- Once the arc is ignited it melts and evaporates metal salts (sodium) within the lamp.
- The light doesn't arrive at full power until the salts are fully evaporated into plasma (which can sometimes take up to 10 minutes). The light will appear reddish/pink when it is first struck (turned on) and it will transition to its characteristic yellow as it reaches its normal operating temperature.
- HPS Lamps contain toxic mercury which can present a waste disposal issue.
- Sodium vapor lights are **omnidirectional**, producing light in 360 degrees. This is a major inefficiency because at least half of the light needs to be reflected and redirected to the desired area being illuminated. It also means that more accessory parts, like lenses, housings, and reflectors, are required in the light fixture itself in order to reflect or focus the luminous output of the bulb, thus increasing unit costs.

Where are Sodium Vapor Lamps Commonly Used?

Common applications for sodium vapor lighting includes street lighting, parking lots, flood lighting, wall packs, warehouse lighting, industrial lighting, as well as tunnel lighting. Essentially any application where CRI isn't a major concern.

What's The Difference Between HPS and LED Lights?

Energy

These are two different technologies with entirely different methods of producing light. Sodium vapor bulbs contain metals that are evaporated into inert gas within the glass casing while LEDs are a solid state technology. LEDs waste much less energy producing waste heat. You can expect a **30%-70% reduction** in energy consumption by converting HPS to LED.

Maintenance

In this area, HPS is drastically inferior to LED. The extremely low maintenance and replacement costs with LEDs is a major cost benefit over the long term. LED fixture's rated lives can be greater than 100,000 hours (more than four times that of HPS). Having to purchase one fixture versus 3 or 4 bulbs or ballasts over the course of time in addition to reduced downtime, operating costs, and time monitoring light quality are all significant advantages to LED.

Performance

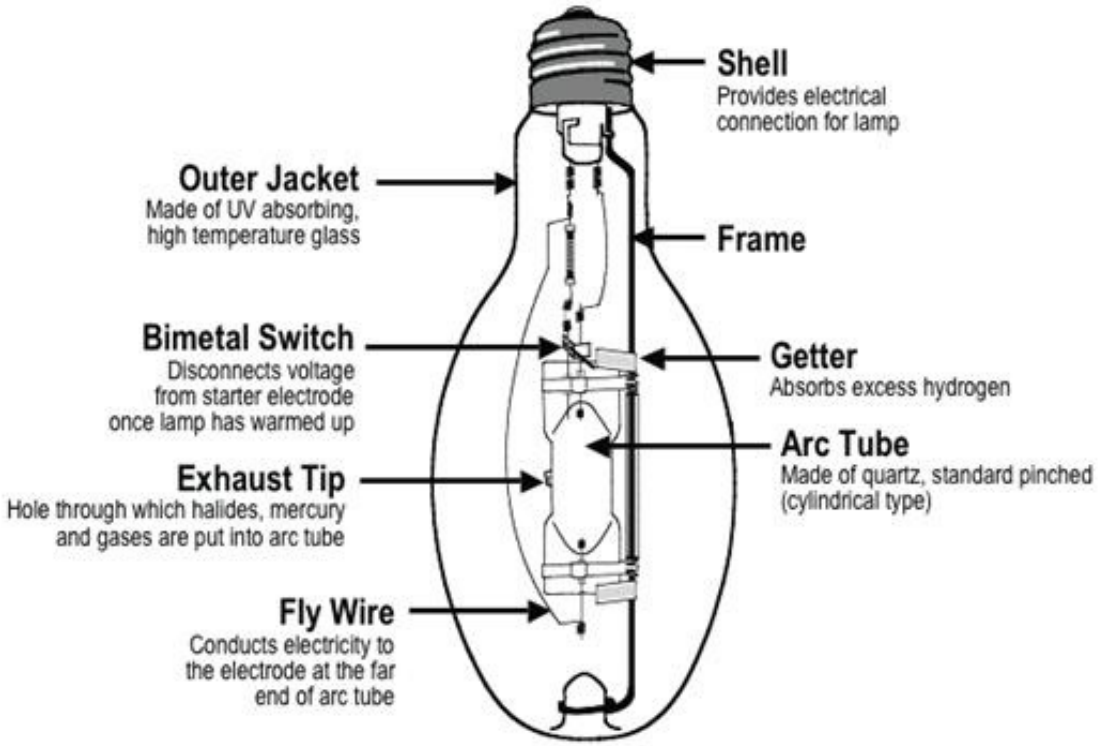
Sodium lamps have the **worst color rendering** of any bulb. They produce a dark yellow glow which is generally a very low quality aesthetic. LEDs have a significantly better variety of high Correlated Color Temperature (CCT) options for users, thus eliminating the monochromatic appearance of objects under HPS lights. The bottom line is that having lost their traditional advantage of being the most energy efficient bulb on the market, there's very little reason to use HPS lamps considering the performance of LED lighting.

Metal Halide (MH) Lamps

Metal Halides are another form of **High Intensity Discharge (HID)** lamp, they are compounds formed when metal and halogen elements combine. They include things like sodium chloride (salt) and uranium hexafluoride (the fuel used in nuclear energy reactors).

- Metal Halide lamps produce light by passing an electric current through a combination of mercury and metal halide gas.

- They function very similarly to other HID lamps, the principal difference being the composition of the gas.



Tell me about Metal Halide Lamps...

When compared to High Pressure Sodium, Metal Halides have a higher CRI. More notably, they produce a higher correlated color temperature, often in the 4,000-5,000K range, resulting in a much "whiter" light.

- This means that metal halide bulbs can be useful for high intensity **lighting applications** similar to HPS, including indoor and outdoor lighting applications.

Metal Halide lights have the longest warm-up time of any HID light on the market. Many metal halide lamps used in warehouses and sports facilities take 15-20 minutes just to reach their normal operating temperature. The average Metal Halide bulb has an approximately 6,000 to 15,000 hour useful life.

Where Are Metal Halide Lights Commonly Used:

Common applications for metal halide lighting includes any outdoor lighting application, as well as **high bay lighting** for warehouses, gymnasiums, manufacturing facilities, and any large indoor space.

Metal Halide Parking Lot Lighting

What's The Difference Between Metal Halide and LED Lights:

Energy

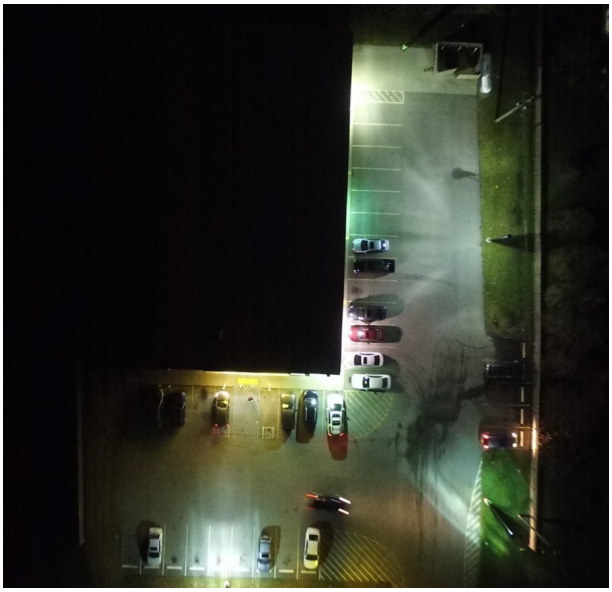
Metal Halide are inefficient energy consumers. For example, typical Metal Halide Lamp wattages used for High Bay application would range from **175 Watts to 1000 Watts**. The higher the wattage the higher the light output. A 400w or 1000w fixture can **cost up to $209 and $525 to operate per lamp**, per year, in electricity alone. Common wattages for LED high bay fixtures can range from **95 Watts to 495 Watts**, often resulting in a **40%-60% reduction in energy consumption**.

Maintenance

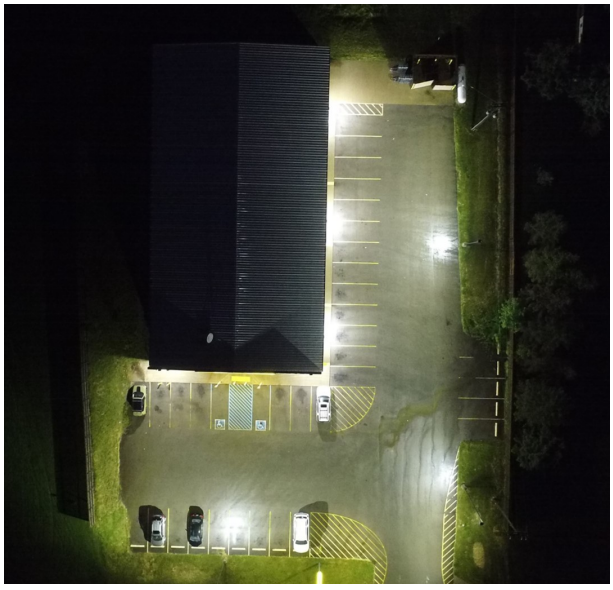
Metal halide lights are relatively cheap to purchase but they are expensive to maintain. Instead of ceasing to function properly once a fuel source is significantly reduced like, Metal Halide, LED light output degrades VERY SLOWLY over time. For example, by converting conventional 400w HID High Bay Lighting to LED, a typical building with industrial light fixtures can **save up to $5,341 over the course of 3 years in** maintenance costs alone

Performance

Metal Halides generate a very cool white light, available in color temperatures as low as 3,000-5,000K. Of the HID lamps available, they're perhaps the best source of high CRI white light on the market. That being said, the very long warm up times, and omni-directional light emission and lack of ability to dim are a real concern. As a result of the Multi-Point design, LED lights provide very EVENLY distributed light. What this means is that light levels across a given surface will vary less between fixture mounting locations.



Parking Lot with Metal Halide Lamps



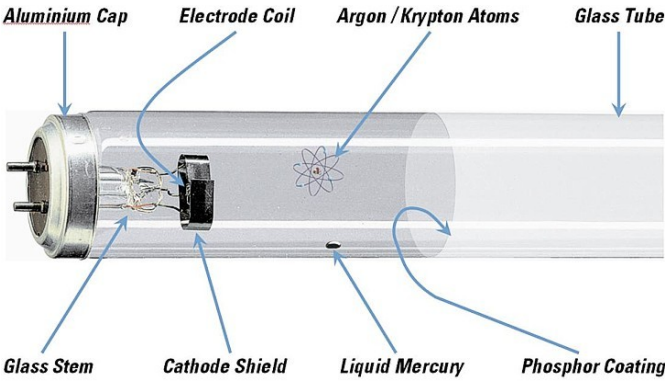
Parking Lot with LED Lighting

Fluorescent and Compact Fluorescent Lighting (CFL):

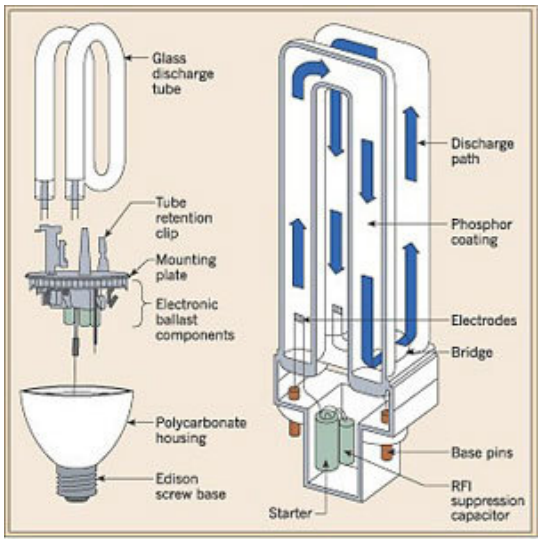
Standard Fluorescent lights are a specific type of gas-discharge light, generally available in tubes 24 to 96 inches in length.

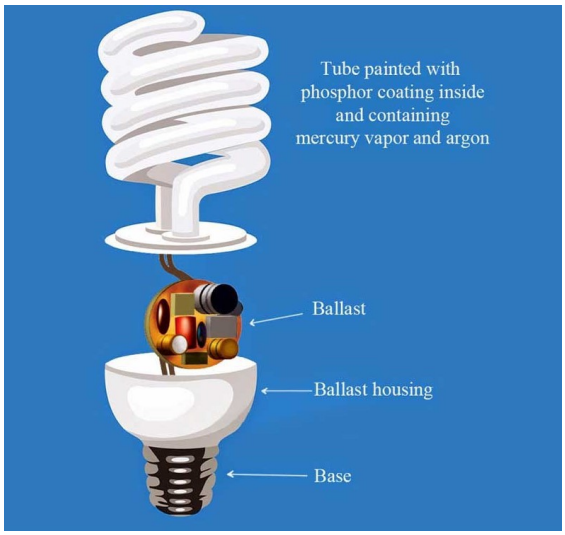
- Fluorescent lamps produce light by converting ultraviolet emissions with a fluorescent coating on the inside of the tube.

- As the fluorescent light ages, more and more voltage is required to produce the same amount of light until eventually the voltage exceeds the fixed resistance provided by the ballast and the lamp fails.



CFL is an acronym for Compact Fluorescent Light. The lamps use a tube, like Fluorescent lights, which is curved or folded to fit into a smaller space than a standard Fluorescent lamp, thus creating more surface area. The principle of operation remains the same as in other fluorescent lighting; emitted ultraviolet light is converted into visible light as it strikes the fluorescent coating (as well as into heat when absorbed by other materials such as glass).





Tell me about Fluorescent and CFL Lighting…

Fluorescent technology has been around for more than 100 years and it use to represent an efficient way to provide lighting over a large area, usually indoors. Fluorescent lighting doesn't typically take too kindly to cold temperatures or temperature fluctuations.

Fluorescent lamps age significantly if they are frequently switched on and off. Note how the lights in bathrooms or warehouses that are on occupancy sensors are always the first to go out. Burning life is extended if lamps remain on continuously for long periods of time. Fluorescent lighting is also omnidirectional, producing light in 360 degrees requiring light to be reflected and redirected to the desired area.

Where Are Fluorescent Lights Commonly Used:

Common applications for fluorescent lamps include office spaces, warehouses, schools, commercial buildings and healthcare facilities. CFLs are often used as a replacement for incandescent lamps in many applications.

What's The Difference Between Fluorescent and LED Lighting:

Energy

4ft LED tube wattage typically ranges from 12 watts to 20 watts, resulting in a 40%-60% percent reduction in energy consumption. The LED Lamp wattage range is so dramatic due to the need to adapt to the many different applications of fluorescent lighting. It is common for indoor LED fluorescent lamp applications utilize between 2 to 4 lamps per fixture. By using LED Fluorescent Tube replacements in these fixtures, it is possible to **save up to $2,692 per year** for a room currently using fluorescent light fixtures

Maintenance

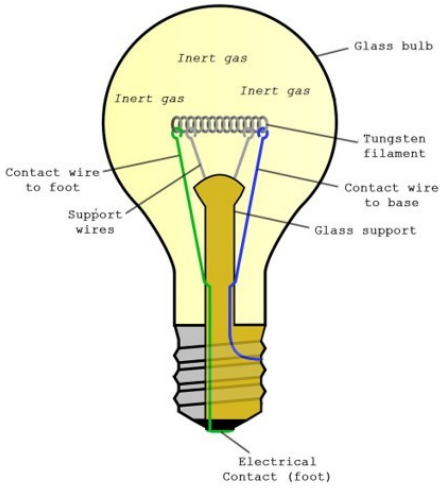
As mentioned previously, the way LEDs generate light and progress through their functional life results in a much longer operating life compared to conventional fluorescent light fixtures. Another advantage realized from LED replacements for fluorescent tubes is that they are not negatively affected by cycling (turning on and off), so they are more reliable in scenarios where lighting may be turned on and off frequently. Lifetimes range from 10,000 to 30,000 hours for typical fluorescent tube, and it can easily **cost up to $1,545 over the course of 3 years to maintain the lighting** in a space utilizing fluorescent light fixtures.

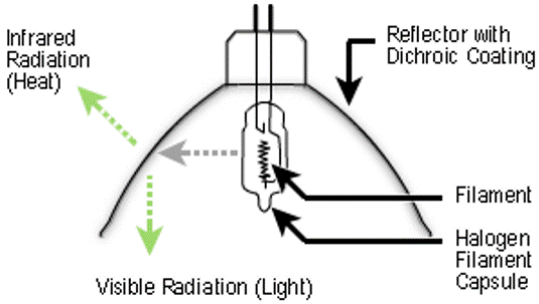
Performance

As a result of the Multi-Point design, LED fluorescent lamp replacements often provide a very EVENLY distributed light pattern. The result, in regards to LED vs Fluorescent, is a more even foot candle distribution from the LED conversion. In addition to the even distribution of light, LEDs are available in a range of color temperatures, and as a result provide a range of options to increase the visual perception of "brightness".

Incandescent Lights:

The incandescent lamp is your classic light bulb. It produces light by heating a wire filament to a temperature that results in the generation of light. The metal wire is surrounded by a translucent glass bulb that is either filled with an inert gas or evacuated (a vacuum).





Tell me about Incandescent Lights:

They're cheap to manufacture and accordingly, they're really cheap to purchase. Incandescent bulbs are widely available and adaptable to a large range of applications Additionally, incandescent lights have an especially good ability to **render color (CRI)**.

Incandescent lights have the worst energy efficiency on the market. incandescent lamps have an efficacy of around 10 lumens/watt. Most of the energy they consume (~90%) goes into producing heat. They also have the worst lifespan on the market. The average bulb lasts around 1,200 operating hours. This means that even though incandescent bulbs are cheap to purchase, you have to purchase 50-100 to equal the lifespan of a single LED lamp. Overall that means high maintenance costs.

Where Are Incandescent Lamps Commonly Used?

Common applications for incandescent lighting includes residential and interior lighting. It is typically not used in outdoor environments or for large organizations because of its short lifespan and poor energy efficiency.

What's the Difference Between Incandescent and LED Lamps:

Energy

Incandescent lights are the worst of all the modern lights in terms of efficiency because so much of the energy (90%) goes towards generating heat instead of light. This all translates to cost. Although the sticker price is low, incandescent bulbs will cost you money over time based on the inefficient way in which they consume energy. LEDs are extremely energy efficient compared to every other available commercial lighting technology, including incandescent.

Maintenance

Incandescent lights have the worst lifespan of any bulb on the market (roughly 1,200 hours). Typical lifespan values for an HID bulbs like HPS or CFL are around 10,000-24,000 hours (10-20 times as long). LEDs last 2-10 times as long as HID bulbs which means they last roughly **50-100 times as long as incandescent.** Incandescent lights will likely need to be purchased 20-50 times and the associated labor costs will need to be paid in order to attain the equivalent lifespan of a single LED light.

Performance

The color rendering index (CRI) for an incandescent bulb with a color temperature of 2700K is 100. As color temperature rises the CRI ratings drop off only slightly but typically remain above 95. Whereas, CRI for LED is highly dependent on the particular light in question. That said, a very broad spectrum of CRI values is available ranging generally from 65-95.

Next Steps:

How do I determine the next steps to improve my lighting application?

The first step is to speak with a LED lighting solutions provider that is **manufacturer neutral**. Why this approach as opposed to the company you may have used for the past several years? Unless that company has a focus on providing **LED solutions**, it is unlikely that will have the performance focused mentality that is required to obtain the desired results of an LED Lighting project for your municipal, campus, industrial and commercial applications.

A crucial step in any LED project is understanding that **LED Lighting is NOT a commodity**.

Prior decades consisted of building facility managers and building owners evaluating product options purely on cost, assuming that all of the options in consideration were equal in quality. This is not case with LED Lighting.

A solution focused supplier should ask you about your project objectives.

Do you have...

- **Budget constraints?**
- **Return On Investment Criteria?**
- **Energy reduction targets?**
- **Lighting performance requirements?**

The appropriate partner will want to get an understanding of your desired outcome, not just what specific products they can sell you. **Not all LED products are created equal**. There are different levels of value from different manufacturers for different applications, and by working with a company that has the product expertise to recommend a solution that meets your project priorities, you will ultimately achieve the best results. We'd love to know more about your **upcoming lighting project**, or **contact us** and we'll get in touch with you.