Now that we’ve learned about how to shield streetlights, we’re going to learn about the light bulbs themselves. Follow along in your Types of Lights document as we talk about these bulbs. Turn to the second page that says “Indoor Lighting”.

**Incandescent Light Bulbs**

Have you ever looked at the lights in your house? What kind of light bulbs do you see in your lamps or lighting up your front porch? One type of common light bulb is an incandescent light bulb. They’ve been around for a long time, but they’re not being used as much in homes anymore. Why do you think that is? Well, it turns out, incandescent light bulbs are not very energy efficient. What does energy efficiency mean? Energy efficiency can be thought of in terms of input and output. Input is just how much you put into something, and output is what you get out from it. To make a light bulb light up, you need to put energy in and you get light out. Incandescent light bulbs aren’t very energy efficient because for the amount of energy you put in, you do not get very much light out. So where is the rest of the energy we put in going? We want it to provide us with light, but instead it’s giving us more heat than light. For example, if you were to pay one dollar to make an incandescent light bulb turn on, only two to four cents of it is coming out as light. The rest is all heat! So the efficiency of an incandescent light bulb is 2-4 cents over 100 cents, or 2-4%. This is why incandescent light bulbs aren’t energy efficient.

It’s worth keeping in mind that something is perfectly efficient if the output equals the input. This would have 100% efficiency. In the real world, it’s not possible to have something with 100% efficiency.

Efficiencies can be hard to calculate, so we’re going to use something called efficacy. Efficacy is also an output over an input. The amount of energy you have to put in to a light bulb is called the wattage. The amount of light you get out that your eyes see is called the lumens. Efficacy is lumens divided by watts. The efficacy is related to the efficiency, but it is not a percent. The bigger the efficacy, the more efficient the light bulb.

The efficacy of different kinds of lights has to do with how they produce that light. How does an incandescent light bulb produce light? Well, inside the bulb is a thin, metal wire called a tungsten filament. Electricity runs through the filament, making it so hot that it starts to glow brightly, producing light. This is why so much of the energy comes out as heat and the bulbs get very hot to the touch.

One last aspect of light bulbs is called color rendition, meaning that an object a light bulb is illuminating looks its true color. A bulb with poor color rendition will make objects look washed out, a different color, or gray. Color rendition can be measured on the Color Rendition Index (CRI) scale, which goes from 0 to 100, with 0 being very poor color rendition and 100 being perfect color rendition.

As you’re following along in your packet, notice the different wattages, lumens, and CRI numbers for each bulb.
CFL
Another type of light bulb you may have seen in your home is a CFL, or Compact Fluorescent Light. CFL’s are more energy efficient than incandescent light bulbs. If you put in a dollar to light up a CFL, about 12-16 cents comes out as light, which is a lot better than 2-4 cents! So while the incandescent was only 2-4% efficient, a CFL is about 12-16% efficient. CFLs also produce light differently than incandescent light bulbs. There’s gas in the tubes of the CFL bulb. This gas gets excited when electricity goes through the bulb, and that’s what makes it light up. There’s a coating on the bulb that makes the light white.

LED Light Bulbs
You’ve probably heard of this next kind of light as it’s become more and more popular over the years: LEDs or Light Emitting Diodes. The science and technology behind how LEDs light up is a little confusing, but the technology behind white LEDs won a Nobel Prize in Physics in 2014! While these are the most efficient bulbs to date, they are not without problems. Although the light they produce looks white, remember that white light contains all the colors of the rainbow. LEDs contain a lot of blue light, which can have negative effects on human health and wildlife.

Incandescent bulbs and CFLs are generally used indoors. There are a lot of different kinds of light bulbs that are used outside. Since you’re going to be looking at an outdoor scene, let’s talk about some kinds of bulbs that are used outside.

OUTDOOR LIGHTS

Halogen
Halogen bulbs are often found in homes as spotlights or floodlights, in cars as headlights, or at sports fields as stadium lights. These bulbs work in a similar fashion to an incandescent bulb by running electricity through a tungsten filament. Unlike the incandescent, there is halogen gas inside the bulb. When the tungsten burns off the filament, the gas re-deposits it back onto the filament to be reused. Halogen bulbs last much longer than incandescent, but these bulbs are much brighter and burn much hotter than traditional incandescent bulbs.

Mercury Vapor
Most streetlights are classified as being HID, or High Intensity Discharge, of which mercury vapor streetlights were the first. The lamps tend to cast a blue-green light at night. In addition, these lights are very inefficient and get worse over time. They are outlawed on most buildings in the US.

Metal Halide
Metal halide lamps are commonly used in streetlights, parking lot lights, and stadium lights. They are very bright and contribute to a lot of light pollution, but they are fairly efficient. They produce very white light and have good color rendition, meaning that objects under these lights look their true color.
**HPS**
The high pressure sodium lamp (HPS) is the most commonly used street light throughout the world. It produces light by running electricity through a mixture of gases, which produces light. The lamp itself is preferred because it requires little maintenance. These lamps are fairly efficient. They take a while to turn on completely and produce a slight yellow-orange glow.

**LPS**
The low pressure sodium (LPS) lamp works similarly to the HPS lights. Instead of producing white light (all the colors of the rainbow), LPS lamps produce almost exclusively yellow light. The bulb takes several minutes for the bulb to turn on. The light is very yellow-orange and has very poor color rendition.

**LED Street Lamps**
Just as there are LED light bulbs for your house, there are also now LED streetlights. Even though LED streetlights are energy efficient, they tend to be more expensive to initially buy and install because it is such a new technology. Also LED streetlights usually produce a lot of blue light, which can have negative effects on human health and wildlife.

**NBA LED Street Lamps**
Narrow-band amber (NBA) LED street lights are a brand new technology. Rather than emitting all the colors of the rainbow and a lot of blue light, they emit mostly in the yellow. They still have good color rendition, meaning they do not produce a yellow glow like LPS lamps do. Because this technology is so new, these bulbs are not widely available and are very expensive.