CFL *Basics*

Compact Fluorescent Light Bulb

How it works:

All fluorescent lights are long glass tubes with a small heating element, or electrode, at each end. The tube is filled with an inert gas and a small amount of mercury vapor at very low pressure. A CFL is just a long glass tube made into a more "compact" zigzag or corkscrew shape. When electric current passes through the tube the mercury atoms are energized and emit invisible ultraviolet light. When the UV light strikes the fluorescent phosphor coating on the inside of the bulb it is absorbed and the phosphor coating emits the various longer wavelengths of the blue, red, green, and yellow components of white light.

CFLs need slightly more energy when first turned on. Once the electricity flows through the ionized vapor in the glass tube a CFL needs about 75% less energy than an incandescent light bulb. A ballast provides a "surge" to help kick start the CFL and then controls and regulates the current once the electricity starts flowing.

Pros:

- More energy efficient than incandescent bulbs
- Last longer than incandescent bulbs, 8-10 X longer on average
- Save money over the life of the CFL
- Convert more of the electricity they consume into light, and less into heat
- Most effective in areas and rooms requiring prolong periods of light
- Recent improvements in quality and light color
- Becoming more versatile and available for a wider variety of applications
- Up front purchase costs are steadily decreasing
- Many discounts and giveaways available to consumers through local utilities and retail

Cons:

- Fragile, glass, easily broken
- Contain small amounts of mercury
- More expensive "up front" purchase cost
- Known to emit "cooler" or "bluish" light compared to incandescent bulbs
- Not always compatible with dimmer switches, photocells, timers
- Heavier and often larger than comparable incandescent bulbs due to ballast
- Sensitive to extreme temperatures and enclosed spaces
- Not as efficient when bulbs are used often for brief periods, most efficient where they remain on for at least 15 minutes
- Not as simple or easy to dispose of as incandescent bulbs

IL *Basics*

Incandescent Light Bulb

How it works:

A regular incandescent light bulb works using the same principle as the first light bulb invented by Thomas Edison in 1879. Electric current passes through a thin tungsten wire called a filament. Tungsten has extremely high electrical resistance. The wire filament heats up to 2000K+ and glows first red hot then white hot or “incandescent”. The incandescent bulb is sealed and filled with argon, a chemically inert gas, because if air with oxygen surrounded the filament it would burn up. Ninety percent or more of the energy used by an incandescent light bulb is converted to heat rather than light.

Pros:

- Inexpensive to produce and purchase
- Incandescent bulbs produce warm, soft light
- Use cheap, simple technology that has been around for over 100 years
- Easy to dispose of
- Available for many different purposes and applications

Cons:

- Fragile, glass, easily broken
- Energy inefficient
- Light production process generates a lot of heat
- High energy costs over lifetime of bulb
- Thin tungsten filament wears out and breaks
- New standards will phase out more inefficient 100-75-60 watt incandescent bulbs over the next three years
- Burn potential due to high temperatures during operation
- Wear out quickly and need replacement often

LED *Basics*

Light Emitting Diode

How it works:

LEDs produce light when electrons move around within a semiconductor structure of two layers called a diode. A semiconductor is composed of a positively charged component and a negatively charged component. The positive layer has “holes” or openings for electrons to move through. The negative layer has free electrons. When electricity strikes the semiconductor it activates the flow of electrons from the negative layer to the positive layer. The excited electrons emit light as they flow into the positively charged “holes”. While all diodes release light most don’t do it very effectively. In an ordinary diode, the semiconductor material itself ends up absorbing a lot of the light energy. A “light emitting diode” is specially constructed to release a large number of photons outward. They are normally housed in a small plastic bulb that concentrates the light in one particular direction. LEDs have been used in electronics for a long time but are just now starting to become viable for household lighting.

Pros:

- Solid state technology, more stable and durable
- No glass tube or fragile filament to burn out
- Easier and cheaper to dispose of than CFLs
- Perform well outdoors and in cold temperatures
- Very energy efficient, generate very little heat, 85% more energy efficient than incandescent bulbs
- Last longer than CFLs and much longer than ILs
- New semiconductor technology and research forecast decreasing manufacturing costs and lower prices for consumers
- Easy to dim
- Can be built to light up in a variety of colors without using filters
- Offer businesses reduced electricity and maintenance cost

Cons:

- Tend to concentrate light in a particular direction
- Traditionally not well suited for household lighting
- Higher initial “up front” purchase costs
- Individually do not generate as much light as an IL or CFL, so LED bulbs are usually clusters of smaller, individual LEDs
- Vulnerable to high temperatures
- Built around expensive advanced semiconductor materials