Current Comments

Energizing South Central Nebraska

SOUTH CENTRAL PUBLIC POWER DISTRICT, NELSON, NEBRASKA

OBJECTIVE: To make electricity available at the lowest cost consistent with sound economy and good management.

Manager's Column

By
Max Van Skiver

On the following three pages, you will find an article Royce Schott wrote regarding "The Evolution of the Light Bulb". I hope you take time to read it.

AREA LIGHTING

The farm I grew up on had a 300-Watt incandescent bulb in the "yard light". By today's standards, we were working in the dark.

Of course, 175-Watt Mercury Vapor area lights replaced 300-Watt incandescent yard lights. The mercury vapor fixtures produced more light and used about one-third less energy. You might think about 50% less based on the wattages, but the mercury vapor fixtures required a ballast to transform voltage and it required energy to operate. The great thing about mercury vapor fixtures was that they lasted "forever" compared to incandescent yard light bulbs.

The vast majority of the mercury vapor lights installed by South Central Public Power District were 175s. I have no idea how many 175-Watt mercury vapor lights South Central installed and rented over the decades, but it was in the thousands.

Mercury vapor area fixtures were relatively inexpensive, durable, were low maintenance and faithfully provided service for years before failure. For decades, they were the premier way to light farmyards and streets in small towns.

From South Central's point of view, mercury vapor fixtures were the ideal rental light and the District was able to set rental rates accordingly, as long as they operated every night. The margins from the energy they consumed were used to hold down the rental charge. The fact that they seldom required maintenance further held down the cost of rental, as we knew we could *expect* to go years between service calls for any individual light.

The Energy Policy Act of 2005 outlawed mercury vapor sale in the U.S. as of 2008 because they were less energy efficient than competitive technologies. In spite of that fact, you can still see mercury vapor lights all across the area at night.

High Pressure Sodium lights were the logical choice to take their place, but I have never liked the deep yellow light they produce. In addition, high pressure sodium lights are more expensive than mercury vapor and not nearly as trouble-free, two big negatives.

From what I consider a "common sense" point of view, the gasoline we have to burn to perform the more frequent maintenance they require counterbalances a lot of the electricity savings credited to high pressure sodium fixtures.

We have been experimenting with the "new kid on the block", LED area lights. Unfortunately, they are much more expensive than are high pressure sodium lights, but at least the light provides better color rendition and they should be much more durable. Time will tell.

The Evolution Of The Light Bulb

By Royce Schott

The common light bulb has evolved rapidly over the past few years. Incandescent bulbs gave way to Compact Fluorescent Lamps (CFL), which enjoyed the spotlight for a short time but have already been largely replaced by the latest technology, Light Emitting Diode (LED) lighting.

There are profound differences in the three designs:

- ◊ An incandescent bulb produces light by heating a filament wire to a high temperature until it glows.
- ◊ A CFL contains a mixture of Argon and Mercury gases that produces invisible ultraviolet light (UV) when the gas is excited by electricity that, in turn, excites a fluorescent coating (Phosphor) on the inside of the tube which then emits visible light.
- ◊ An LED lamp contains electrons that recombine with electron holes, releasing energy in the form of photons and illuminating the bulb.

Although there were earlier designs of incandescent bulbs, Thomas Edison and Joseph Swan were credited with inventing a version that was able to rise above the others due to a combination of three factors: An effective incandescent material, a higher vacuum than others were able to achieve (by use of the Sprengel Pump), and a high resistance that made power distribution from a centralized source economically viable.

Several improvements in filament construction, from carbonized bamboo to Tungsten, among many others, and evolving designs improved the life and efficiency of incandescent bulbs. Among those notable improvements; Moving from vacuum only (which allowed the inside of the bulb to darken), to filling the bulb with an inert gas such as Argon or Nitrogen, which retards the evaporation of the tungsten filament compared to operating in a vacuum.

By 1964, improvements in efficiency and production of incandescent bulbs had reduced the cost of providing a given quantity of light by a factor of thirty, compared with the cost at the introduction of Edison's lighting system.

Of the power consumed by incandescent light bulbs, 95% or more is converted to heat rather than visible light.

Incandescent Timeline

- ⇒ 1878—Thomas Edison awarded Patent for "Improvement in Electric Lights"
- ⇒ 1885—300,000 General lighting lamps sold, all with carbon elements
- ⇒ 1904—Tungsten elements are patented, about 50 million light sockets in the US
- ⇒ 1945—795 million lamps used
- ⇒ 2014—Federal law phases out the most common incandescent bulbs manufactured

In the US, federal law scheduled the most common incandescent light bulbs be phased out by 2014, to be replaced by more energy efficient bulbs. This led to the development of several alternatives with the first to gain momentum being the Compact Fluorescent Lamp (CFL).

The CFL uses 1/3 to 1/5 the electric power of an incandescent bulb and can last 8 to 15 times longer.

The origin of the CFL can be traced back to Peter Cooper Hewitt who created a version in the late 1890s that was used in photographic studios and industries.

A high-pressure vapor lamp was patented in 1927. In the 1930s, George Inman teamed with General Electric to create a practical fluorescent lamp that was first sold in 1938. The first fluorescent light bulb and fixture were displayed to the general public at the 1939 New York World's Fair.

A spiral CFL was developed in 1976 in response to the 1973 oil crisis. The project was shelved when GE realized it would cost $25 million dollars to build new factories to produce the bulbs. Philips introduced a spiral screw-in lamp with an internal magnetic ballast in 1980. Eventually, several copied the design, including the Chinese who made a helical design commercially available in 1995.

Compact Fluorescent Lamp Timeline

⇒ 1890—Cooper Hewitt Lamps invented for photographic studios

⇒ 1938—GE begins selling fluorescent lighting

⇒ 1976—Spiral CFL invented by Hammer for GE

⇒ 1980—Philips Model SL, first screw-in lamp with integral magnetic ballast

⇒ 1995—Helical CFLs become commercially available

⇒ 2016—GE announces phase out of CFL production

CFLs never really caught on with the public. The color of the light, delay in coming on, the noise that some emitted, and incompatibility with cold temperatures made them unattractive. Also, the lifespan of a CFL bulb is significantly shorter if turned on and off frequently. A CFL that is frequently cycled on for only 5 minutes or so then turned off can reduce the lifespan to that comparable to an incandescent bulb. This makes the expense of replacement far offset the savings in electricity usage.

In 2016, General Electric announced the phase out of CFL production. The next big thing, LED lighting, had come on the market and prices had dropped steadily, falling below $5.00 per bulb by 2015. CFLs were also having difficulty qualifying for Energy Star rating under newer regulations.

The first LEDs were developed in the early 1960s, however they were low-powered and only produced light in the low, red frequencies of the spectrum. The existence of blue LEDs and high efficiency LEDs led to the development of the first "white LED", which employed a phosphor coating to partially convert the emitted blue light to red and green frequencies creating a light that appears white.

The development of LED lighting took off in 2007, after the Energy Independence and Security Act (EISA) established a "Bright Tomorrow Lighting Prize" competition to challenge industry to develop replacements for 60W incandescents and PAR 38 halogen lamps.

Philips was awarded the prize for a 60 watt incandescent replacement in 2011 and the LED lighting industry exploded. By 2015 LED lighting had become the choice of manufacturers and consumers. The market continues to grow as better options and lower prices make LED lighting the best and most efficient choice available.

Light Emitting Diode (LED) Timeline

⇒ 1960s—Low, red frequency LEDs developed

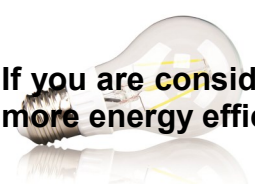
⇒ 1994—Shuji Nakamura of Nichia Corp. demonstrates high-brightness blue LED

⇒ 2007—Energy Independence & Security Act (EISA) establishes "Bright Tomorrow Lighting Prize" competition

⇒ 2008—Energy Star program for solid state lighting is launched

⇒ 2011 –Philips wins EISA prize for 60W bulb replacement

Sources: www.energystar.gov, Wikipedia




LED Lighting

If you are considering changing out an incandescent or even a compact fluorescent bulb to a more energy efficient LED bulb, please consider these options and facts.

COLOR:

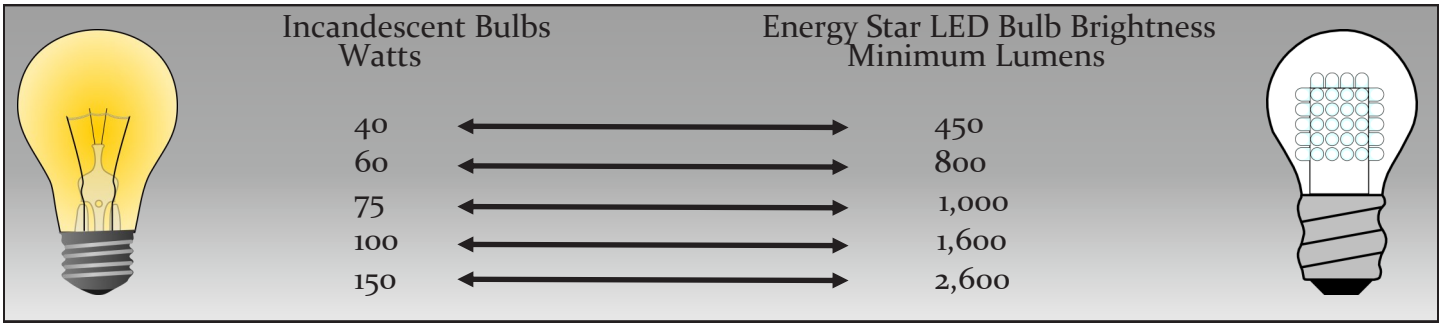
Color is the term used to describe the look of the LED lamp's output. The rating goes from warm to cool. A warm light is the more yellow looking light most often associated with incandescent bulbs. Warm lighting is used more for indoor applications and small areas. A cool light is more towards the blue side of the color spectrum. Cool light is more popular for outdoor lighting and task lighting. Color is rated on a scale known as the Kelvin scale. Kelvin is a unit of measurement used to describe the hue of a specific light source. This is not necessarily related to the heat output but rather the color of the light output. The higher the Kelvin value of the light source, the closer the light's color will be to actual sunlight. Below is a chart showing Kelvin ratings for typical LED lighting.

BRIGHTNESS & ENERGY EFFICIENCY:

When shopping for LED light bulbs, compare lumens to be sure you're getting the amount of light, or level of brightness, you desire.

Incandescent bulbs were traditionally measured in watts. For example a 60 watt incandescent bulb is a very common "size" of light bulb. When purchasing LED bulbs, you should base your selection on the lumen output. The brightness, or lumen levels, of the lights in your home may vary widely, so use the chart below to select the LED bulb that is right for the bulb you are replacing.

Remember for brightness, look for lumens, not watts. Lumens indicate light output. Watts indicate energy consumed. Energy Star certified LED bulbs provide the same brightness (lumens) with less energy (Watts).



The heat produced by an LED lamp is absorbed into a heat sink. When comparing LED bulbs, a heavier weight bulb usually means a better heat sink, resulting in longer bulb life. We recommend Energy Star certified LED bulbs. Energy Star means high quality and performance, particularly in: Color Quality, Light Output & Peace of Mind due to testing and warranty requirements.

The Residential LED incentive is no longer offered by South Central PPD and NPPD, however, we are available for answering questions about LED lighting.

CURRENT COMMENTS
Newsletter of the
SOUTH CENTRAL
PUBLIC POWER DISTRICT
Nelson, Nebraska
NOTICE
The regular meeting of the board of directors of South Central Public Power District is held the third Tuesday of each month at 9 a.m. at the district's office in Nelson, Nebraska.
Current Comments Editor: Royce Schott

Nelson Office Hours
(8 a.m. to 5 p.m., Monday through Friday)

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