Improving energy efficiency through solid-state lighting

Incandescent

Light is produced by heating a tiny coil of tungsten that glows but 95% of the energy is lost as heat.

Bulb life: 1000 hours

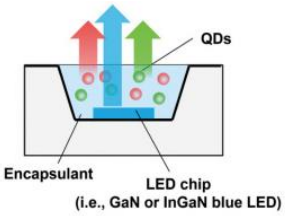
Energy $ Saved: --

Fluorescent

UV light is produced by an electric current passing through inert gas. This light is converted to white light through a phosphor coating on the interior of the bulb. CONTAINS MERCURY!

Bulb life: 10,000 hours

Energy $ Saved: 75%



Solid-state LED

Light-emitting diodes produce high energy light via applied electrical current. Red and green phosphors (solid materials that emit light) encasing the LED absorb the blue light and convert it into lower energy light; the combination of blue, green, and red emission produces white light.

Bulb life: 25,000 hours

Warm light → **Cool light**

Lighting has a huge impact on the atmosphere of the setting you're in, most notably the color temperature of the light. Replicating the warmer light (like sunlight) in LED's has been difficult because the materials for red emitters are lagging behind higher quality green emitters. Current research efforts are focused on improving the quality, efficiency, and stability of red and green phosphors that have a direct effect on the emitted light.

Semiconductor quantum dots are excellent phosphors because they convert nearly every absorbed photon into an emitted photon=great efficiency. Scientists can design what color light the particle emits by synthetically controlling particle size. Currently, most high quality quantum dot phosphors contain **toxic** cadmium. The samples included with this display are CdSe (cadmium selenide) because these materials are stable in air/light for long periods of time. Work in the Cossairt lab focuses on providing cadmium-free materials for display and lighting applications (see below-Indium phosphide quantum dots!).