

## EVALUATION OF LAMPS FOR ENERGY CONSERVATION

Twenty percent of all electricity generated in the United States today is used for lighting.

Energy efficiency for all light sources is the measure of how much light is produced, measured in lumens, in relation to the amount of energy used, measured in watts. Lumens per watt ratings are similar to the familiar measure of energy efficiency, miles per gallon.

Some light sources convert electricity into light more efficiently than others, thereby delivering more light for the same amount of electricity. For example, a 40 watt fluorescent tube that delivers 66 lumens per watt is more than 5 times as efficient as a 40 watt incandescent bulb that delivers 12 lumens per watt.

### INCANDESCENT LAMPS

Incandescent lamps are the most energy wasteful; 90 percent of the energy consumed by an incandescent lamp is dissipated as heat, not light. This inefficiency is due to the process of using electricity to heat a coiled tungsten filament in a vacuum bulb until it glows, rather than converting electricity to light more directly.

Efficiency increases as wattage increases. For example, one 100 watt incandescent bulb has an output of 18 lumens per watt while a 60 watt bulb produces 14 lumens per watt. The substitution of one 100 watt bulb (1800 lumens) for two 60 watt bulbs (1680 lumens) produces more light and uses less electricity.

"Longlife" bulbs are the least efficient of all incandescents because light output is sacrificed in favor of long life.

A tinted bulb has a lower light output than a standard incandescent bulb of the same wattage because the coating on the bulb inhibits light transmission.

Tungsten halogen lamps differ from the standard incandescent by addition of halogen gases which keep the glass bulb from darkening by preventing the filament from evaporating. The lumen per watt rating is approximately the same for both types of incandescents, but tungsten halogen lamps have a life span approximately four times that of a standard bulb and average 94 percent efficiency throughout the extended lifetime. Special fixtures are required and the surface of the bulb reaches very high temperatures during operation.

Reflector (R) lamps are incandescents with an interior coating of aluminum that directs the light to the front of the bulb. Designed for use in recessed or directional fixtures, R lamps project a cone of light out of the fixture and into the room. In these fixtures that tend to trap light inside, a 50 watt R lamp will provide better lighting and use less energy than a 100 watt standard incandescent bulb.

Parabolic aluminized reflector (PAR) lamps are reflector lamps with a heavy glass lens which makes them an appropriate choice for outdoor flood and spot lighting. They have longer lifetimes with less depreciation than standard incandescents.

Ellipsoidal reflector (ER) lamps are ideally suited for recessed fixtures because the beam of light produced is focused two inches ahead of the lamp to reduce the amount of light trapped in the fixture. In a directional fixture, a 75 watt ellipsoidal reflector lamp delivers more light than a 150 watt R lamp.

### FLUORESCENT LAMPS

Fluorescent lamps do not depend on the buildup of heat to produce light. They convert energy to light by using an electric charge to activate gaseous atoms within the fluorescent tube. The charge is sparked in the ballast and flows through the cathodes in each end of the tube. The resulting gaseous discharge causes the phosphor coating to fluoresce and emit light. Because the buildup of heat is required for production of light, the process by which fluorescent lamps convert electricity to light is up to five times as efficient as the incandescent process.

The efficiency of a fluorescent lamp increases as the length of the tube increases. Use the longest length practicable rather than multiples of short lengths.

### HIGH INTENSITY DISCHARGE LAMPS

Three types of HID lamps are available: mercury, metal halide and high pressure sodium. All three are more efficient than standard incandescent bulbs and are commonly used for lighting large areas such as parking lots, arenas and lobbies. Each type requires a specially designed ballast.

Of the three, mercury lamps are the most commonly used outdoor lighting source. They have the lowest installation cost and a very long life. Clear mercury lamps have poor color rendition, they accentuate blue tones, but color corrected deluxe cool white or deluxe warm white lamps approximate the color rendition of incandescents.

Metal halide lamps are more efficient and have better color rendition than mercury lamps. They are widely used for general commercial interior and exterior lighting.

High pressure sodium lamps are the most energy efficient light sources currently available. The color produced by these lamps is golden white which grays the color of red and blue objects.

Apart from the color rendition, HID lamps pose one potential drawback, a start-up delay from 1 to 7 minutes from the time they are switched on until they fully illuminate.