

LIGHTING

A Factsheet from Austin Energy's Green Building Program

The most efficient light is the one that's not on. Take advantage of Austin's sunny skies and abundance of daylight. It's free, and it's the most energy efficient way of illuminating a building. You can design room, window, and overhang proportions to reduce summer heat gain, promote winter warmth, and maximize light while avoiding glare. Of course, daylighting is not always adequate or available. Electric lighting should be used to supplement daylight and provide appropriate light levels for particular spaces. Keep in mind the following general information:

- Lighting can account for up to one-fifth of a home's energy consumption and uses about one-fourth of all the electricity produced in the United States.
- The electricity we use for lighting is generated by the burning of fossil fuels, adding tons of pollutants to the atmosphere.
- Traditional incandescent bulbs waste 90% of the energy they use.
- The "fuel" efficiency of a compact fluorescent is comparable to replacing a car that gets 20 miles per gallon with one that gets 100.
- Dimmers provide more lighting options and reduce energy costs. (Note that they may not work cost-effectively for fluorescents, and shouldn't be added to ceiling fans, unless the fan is designed to accommodate a dimmer.) Timers and/or motion detector lights also promote more efficient electricity use.

Quantity vs Quality

When designing electric lighting for a particular space, both quantity and quality of light need to be considered. For both of these issues, consider the following factors: room/building layout, hours of occupancy, type of activity in the space, and age of occupants.

Avoid overlighting a space. In the past, there was a misconception that the more light in a space, the higher the quality. Not only does overlighting waste energy, but it can also reduce lighting quality.

With regard to quality of illumination, there are three issues that should be considered: glare, uniformity of illumination, and color rendition. Glare is a visual discomfort caused by an excessively bright light source. A bright object in front of a dark background usually will cause glare. Too much contrast causes glare and makes visual tasks more difficult.

Uniformity addresses how evenly light is spread over a task area. Two factors may compromise uniformity: improper fixture placement, and fixtures that are retrofitted with reflectors that narrow the light distribution.

Light sources vary dramatically in their ability to accurately reflect the true colors of people and objects. A measure of this ability is the color rendering index (CRI). The CRI is a scale from 1-100, where higher CRI represents better color rendering. CRI's in the range of 75 to 100 are considered excellent, 65-75 good, 55-65 fair, and 0-55 poor. Daylight is considered ideal, with a CRI of 100.

Light Source Selection

Two types of lamps are commonly used in residential applications: incandescent and fluorescent. The performance of some common light sources is compared in the following table.

Light Source	Wattages	Average Rated Life (Hrs)	Color Rendering Index	Life Cycle Cost
Standard Incandescent	3-1,500	750-2,000	98+	High
Halogen Incandescent	10-1,500	2,000-4,000	98+	High
Fluorescent	4-215	7,500-24,000	49-92	Low
Compact Fluorescent	4-40	10,000-20,000	82-88	Moderate

ENERGY

Whenever feasible, seek alternatives to the energy wasting incandescent lamps. With recent advances in compact fluorescents and halogen lamps, the use of standard incandescent lamps is difficult to justify. In fact, if all the incandescent light bulbs in U.S. households that are used more than four hours a day were replaced with compact fluorescents, we would save 32 billion kilowatt-hours of electricity a year.

Fluorescent and Compact Fluorescent Lamps

Fluorescent lamps are the most commonly used commercial light source in North America. Their popularity can be attributed to their relatively high efficacy, diffuse light distribution, and long operating life. Improvements in the phosphor coating of fluorescent lamps have improved color rendering and made fluorescent lamps acceptable in many applications previously dominated by incandescent lamps. In addition, compact fluorescent lamps (CFLs) are energy-efficient, long lasting substitutes for incandescent lamps. Some statistics from the Rocky Mountain Institute indicate that each incandescent bulb replaced with a CFL prevents the emission of 1,000 to 2,000 pounds of carbon dioxide from power plants (a leading cause of global warming) and 8 to 16 pounds of sulfur dioxide, which causes acid rain. One CFL also eliminates the need to produce and dispose of up to a dozen incandescent bulbs. Each CFL you install saves you roughly \$25-50 over the lifetime of the bulb.

Light Source	Advantages	Disadvantages	Applications
Standard Incandescent	<ul style="list-style-type: none"> • Can be sharply focused • Flattering warm color • Cozy atmosphere • Low purchase cost • Easily dimmed • Large variety • Good/Excellent lumen maintenance 	<ul style="list-style-type: none"> • Inefficient • High operational cost • Short life • Produce lots of heat (90% heat, 10% light) • Voltage sensitive • Vibration sensitive 	Accent
Halogen Incandescent	All of the attributes of standard incandescent, plus: <ul style="list-style-type: none"> • More efficient • Longer life • Excellent lumen maintenance 	<ul style="list-style-type: none"> • Even hotter than standard incandescent • Serious fire hazard • Limited fixture choice 	Task lighting for tasks requiring acute vision
Fluorescent and Compact Fluorescent	<ul style="list-style-type: none"> • Diffuse light • Wide color range • Very Efficient • Long life • Less heat produced (up to 80% cooler than incandescent bulbs) • Good lumen maintenance 	<ul style="list-style-type: none"> • Very limited beam control • Less fixture choice • Fewer bulb choices 	General light for larger areas: <ul style="list-style-type: none"> • Offices • Industrial • Retail

Resources

See "Lighting Consultants" in Yellow Pages

Illuminating Engineering Society of North America
 120 Wall St., 17th floor.
 New York, NY 10005
 (212) 248-5000
www.iesna.org

Check out the following web sites:

- <http://www.lightsite.net>
- <http://www.energyguide.com>
- <http://www.efi.org>
- <http://www.sylvania.com>
- <http://www.lightsofamerica.com>
- <http://www.lighting.philips.com>
- <http://www.energystar.gov/products/cflbulbs.html>
- <http://www.energystar.gov/products/cflbulbs.html>