

## More Light for Your Money

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As electricity used for residential lighting becomes more expensive, it is wise to get the most light possible for the money spent. Light quality and quantity necessary for seeing tasks clearly and avoiding accidents need not be reduced. Knowledge of how less expensive lighting can be achieved will make the difference.

### Amount of Light for Electricity Used

The amount of electricity used by incandescent bulbs or fluorescent tubes is measured in *watts*. The amount of light produced by a bulb or tube is measured in *lumens*. Getting the most lumens per watt is one approach to energy efficiency. Longer-life incandescent bulbs are useful where bulb-changing is difficult or hazardous, but the lumen output has been reduced to extend bulb life. Compare the lumens per watt in the accompanying table and note that fluorescent tubes give much more light per watt than incandescent bulbs. The life of a fluorescent tube is much longer, so the higher initial cost is spread over several years and the operating cost is lower.

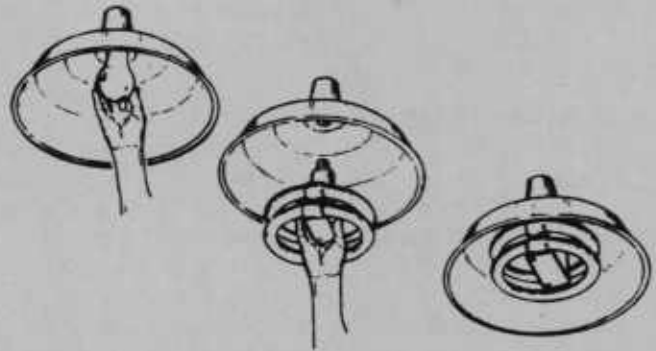
**Incandescent bulbs**, most commonly used in homes, glow when filaments are heated to a high temperature by electricity flowing through. Incandescent lighting is actually inefficient—only about 15% of the energy input becomes visible light and the rest is heat.

**Reflectorized incandescent bulbs** have silver or aluminum reflector coatings to direct light where needed. While lumens produced are no greater than regular incandescent bulbs, available light at point of use is perhaps twice as great. For task lighting, a spotlight or floodlight in a suitable fixture is a good choice. Spotlight reflector bulbs direct light in a narrow beam. Floodlight bulbs spread light over a larger area and are well-suited for recessed ceiling fixtures. Concentric ring shields available for most fixtures help reduce glare.

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**PAR bulbs** are reflectorized lamps molded out of heavy, heat-resistant glass so they can be used outdoors. They are unaffected by rain or snow but must be installed in fixtures that have a weather-tight seal at the socket.

**Fluorescent tubes** use electrical energy much more efficiently than incandescent bulbs. Electrons emitted by an electrode in a conventional fluorescent tube excite atoms, producing ultraviolet light. This ultraviolet light causes the phosphor layer that coats the inside of a fluorescent tube to fluoresce, emitting visible light but very little heat. Deluxe warm white tubes are recommended for enhancing yellow, orange and red. Deluxe cool white is used with blues and greens and makes skin colors attractive. Adapters for circular tubes are available for table lamps and ceiling fixtures. When a fluorescent lamp is turned on, it should stay on at least 15 minutes—if switched on and off more frequently, tube life is drastically reduced.



Adaptor for circular fluorescent tubes permits their use in conventional incandescent lighting fixtures.

**Electrodeless fluorescent bulb** is a new version being refined and readied for market by the Lighting Technology Corporation in a research and development project supported by the U.S. Department of Energy. In this new LITEK bulb, a small electronics package in the bulb base pro-

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## Incandescent

Regular bulbs		
Watts	Lumens	Average rated life (hrs.)
25	235	2,500
40	455	1,500
60	870	1,000
75	1,190	1,000
100	1,750	1,000
150	2,880	1,000
200	4,010	1,000
Long-life bulbs		
55	775	3,000-4,000
92	1,490	3,000-4,000
138	2,310	3,000-4,000

duces a radio frequency signal which sets up a magnetic field. This magnetic field, like the electrons emitted in the conventional fluorescent tube, excites atoms. The bulb will use one-third the energy needed for equivalent incandescent lighting and emits less heat. Energy and cost savings, along with longer bulb life and ability to use standard incandescent fixtures, give this new light source attractive advantages.

**Mercury bulbs** have no wire filament but operate with a combination of rare gases. They provide 50 to 60 lumens per watt, compared to 20 lumens per watt for an incandescent bulb. The average rated life of a 175-watt bulb is 20,000 hours provided it is used at least 3 hours each time it is turned on. The mercury bulb must be used in a special fixture designed to accommodate it. The deluxe white bulb provides good color rendition. For exterior residential use, this bulb saves money because of its long life.

### Amount of Light Needed

The amount of total light needed in each room, according to the tasks usually done there, has been calculated by the Illuminating Engineering Society in the form of recommended lumens per square foot of room area. To check for adequate amount of light, first determine square footage of room. Then multiply by appropriate factor: living room, 80; dining room, 40; kitchen, 80; bathroom, 60; bedroom, 70. This gives total lumens needed. Using the table, add lumens from each light source in room (include ceiling light, portable lamps, any other source of light). If bulb is in a recessed fixture, reduce lumens by half. Compare actual total with recommended total.

### Effect of Room Colors on Amount of Light

The light emitted from various light sources is partially absorbed by the colors of the surfaces which it strikes. Each color has a percentage of reflectance (some paint chips show this percentage on the back). White has the most reflectance with pale yellow ranking next. Pale tints range

## Fluorescent

Straight tubes			
Watts	Lumens (standard colors)	Lumens (deluxe colors)	Average rated life (hrs.)
14	700	470	9,000
15	870	600	9,000
20	1,300	850	9,000
30	2,360	1,530	18,000
40	3,150	2,200	18,000
Circline tubes			
19	825	630	12,000
22	1,000	850	9,000
32	1,800	1,350	9,000
40	2,350	1,780	9,000
U-Shape tubes			
40	2,520	1,645	12,000

from 70 to 80% reflectance. Medium tints and tones are in the 50% range. Darker colors reflect very little light—7% for forest green, 8% for marine blue, 15% for light brown, 10% for walnut wood, 21% for medium red. Lighting costs can be reduced in rooms that have ceilings, walls and floors in high-reflectance colors.

If the colors used on the floors, walls or ceiling are medium to dark, the amount of light available for seeing will be reduced. The amount of wattage would then need to be increased in order to provide adequate lighting.

### Ways to Achieve "Better Seeing"

Overly bright light is uncomfortable. Shielding the light source from direct view is one method of control. Recessing incandescent bulbs in the ceiling or inside surface-mounted fixtures is a method of shielding. The concentric metal rings used over reflector bulbs is a form of shielding. A special bulb with a metal coating on the globe interior to direct light to ceiling is another method. With fluorescent tubes placed on the wall, a facing board acts as a shield. The top and bottom, or bottom only, are open to allow light to shine up or down and reflect from ceiling and wall surfaces.

Diffusing light to soften the impact is another way of achieving comfortable lighting. Bulbs themselves vary from clear (no diffusion) to various types of coatings. The incandescent "globe bulb" combines the high quality diffusion of a separate, milky glass globe with the light bulb itself. This globe bulb is more expensive than an ordinary bulb, and when the bulb burns out the diffuser is also discarded. However, this bulb fits certain applications where a separate diffuser is not feasible. Bulbs that do not have any shielding or diffusion should be low in wattage to prevent eye discomfort.

Lampshades vary from opaque (no light transmission) to very translucent (much light transmission). An opaque shade should have a white lining so as much light as possible will be usable. An opaque shade is recommended only when walls are very dark. The light spread from the bottom of the shade and the reflected ceiling light from the open shade top are the sources of usable light. For desk use where the lamp is in front of the eyes, use only a slightly translucent shade. For reading in a chair, a moderately translucent shade is recommended. For using a mirror, a very translucent shade is needed to put light on the person's face. The wattage of the bulb should be such that the light does not appear through the shade as a concentrated bright spot.

A lampshade should conceal a bare bulb from view. The bulb should, however, be located near the bottom of the shade to provide the widest possible spread of light. The bottom of a table lampshade should be 38 to 42 inches from the floor, since this is average eye-height for a seated person. The minimum recommended width across the shade bottom is 16 inches.

Three-way bulbs offer a choice of light level and can save energy. For permanently-installed incandescent bulbs, dimmer switches are easily installed. For visual tasks not requiring a high level of light, the lower light level option reduces energy use. Fluorescent dimmers are very expensive; a better solution is having tubes on alternate circuits, so one or both can be turned on to vary the light level.

Careful placement of lamps and directional fixtures so that the most light is available where it will be used is a good way of getting more benefit from the wattage used. A table lamp should be placed 20 inches to the side and 16 inches back from material being read or other task object; floor lamp should be placed 15 inches to the side and 26 inches back.

While the greatest amount of illumination is needed on the task, eye fatigue will result if the surrounding area is too dark, causing the pupil of the eye to change size frequently. In the area adjacent to the task, brightness should be about one-third as much as the task. Further away in the room, the brightness should be at least one-fifth as much.

Background lighting can be achieved with the least wattage by using fluorescent tubes shielded from view by a facing board. Cornice lighting is placed at the top of the wall and provides only downlighting. Valance lighting is used above windows, with light-colored draperies to reflect down-

lighting and a white ceiling above to reflect uplighting. A wall bracket is similar to but may be used in place of a portable lamp for reading, over closets and storage areas with bi-fold or sliding doors, on staircase landings, or a wall over a desk (providing widespread, shadowless lighting).

Plug-in fluorescent lighting units can be used for task lighting in many places. Built-in diffuser aids eye comfort. These units are useful under upper kitchen cabinets to provide countertop lighting, over a washer or dryer, a workbench or sewing area.

### Energy-Saving Tips

Whatever type of lighting is used in a home, keep lamp and lighting fixtures clean and free from dust. Dirt absorbs light and reduces lamp efficiency. Darkened or smoked bulbs give less than rated light output while using the same amount of energy. For most efficient use of energy, darkened bulbs should be replaced before they burn out.

Timers can reduce cost of lighting used to safeguard a vacant house. A timer that automatically varies on and off times each night is especially useful. A timer might also be used to control an outdoor safety light instead of an electric eye that does not turn off the light until dawn, unless an overriding toggle switch has been installed.

Decorative effects can be achieved with lighting that also provide needed background illumination—so extra wattage for purely decorative lighting can be avoided. Ceiling track-lighting units aimed at pictures also reflect light off the wall; floor lights aimed up through plant foliage will reflect off the ceiling. Grazing lights (recessed or surface) placed about six inches out from a stone or brick fireplace will enhance texture by emphasizing shadows on the rough surface.

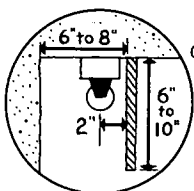
### Summary

Lighting amounts to about 3-1/2% of a home's total energy bill and from 8 to 16% of the total electric bill in homes heated by other than electricity as a fuel source. By following the tips offered in this publication, you can indeed enjoy more efficient light for the money you spend to light your home. Adequate lighting is essential for comfortable living, home decorating, safety and security—but extravagant use beyond basic needs is costly and wasteful of energy.

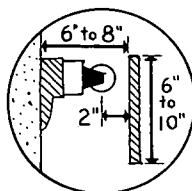
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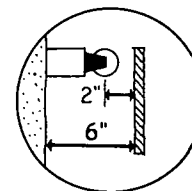
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*Cornice provides downlighting only.*



*Valance above window provides both upward and downward lighting.*



*Wall bracket provides upward and downward lighting.*