

Designs

A design involves the selection of one or more appropriate techniques for lighting a room, and then the selection of appropriate luminaires, lamps, and controls. The design arranges these technologies in the room to support the residents' activities and to enhance the appearance of the room. To create a comprehensive design, you must also consider the room size and shape; styles of architecture and furnishings; the price, availability, and energy requirements of the technologies; and the effort needed to install the equipment. Considering all these factors may seem intimidating at first, so this chapter is arranged to help you quickly identify some designs that you can adapt for your needs.

Typical and energy-efficient alternative designs

This chapter illustrates 36 rooms and outdoor spaces with typical lighting designs and 111 alternatives for replacing the lamps, controls, and luminaires or for remodeling or newly constructing these rooms. Note that many of these rooms are modest in size. They are practical and economical models for average homes. Use the typical designs to identify combinations of lamps, luminaires, and controls that are or would be likely to be used in your rooms. Then look at the alternative designs for energy-efficient ideas.

All of the designs were created without windows so that they could be modified for many building types and furniture arrangements. Nonetheless, be sure to use daylight wherever it is appropriate. See Daylight in the Techniques chapter for more information.

The typical rooms and their lighting designs serve as starting-points for evaluating the energy-efficient alternatives. Building audits, expert opinion, and examinations of plans for manufactured, low-income, and middle-income homes were used to establish the typical designs.

The suggested alternatives to the typical designs were reviewed by lighting experts to ensure that the quality is equal to or better than the typical design. See the descriptions with each design for any adjustments that affect quality. Note that even though the typical design for a particular room may be found in many homes, it may not be the best choice for your purposes: always consider the needs of the residents and the potential for energy savings to be gained from the alternative designs.

Style

Luminaires for homes usually are chosen for their decorative appearance, or style. To avoid issues of style, the luminaires illustrated in this chapter are as simple and unadorned as possible; the general types of luminaires and the lamp or lamps that they contain are the important features to consider for design and energy-efficiency. Different styles of luminaires can be substituted for the illustrated luminaires if the lamps and light distribution are similar. For instance, sconces can be found in a wide variety of styles. Choose styles that will suit the residents' preferences.

Annual operating costs

All of the alternative designs have lower annual operating costs than the typical designs. Refer to the bar graphs shown with each set of designs to see the annual lamp replacement and energy costs for each design. If a design is suggested as "optional," it is not shown in the graph. The assumptions for average hours of lighting use, average hours of use per lamp operation (hours per start), dimming, and occupancy are listed with each graph. Lamp prices, life, and input power are taken from Tables 3, 4, and 5 in the Economics chapter. The lamp life is adjusted for each design to reflect the impact of switching and dimming. All of the economic analyses use the procedure shown in the Economics Worksheet.

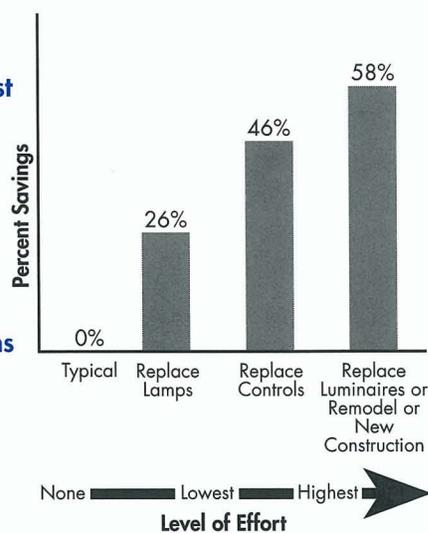
Effort versus savings

Electricity rates in North America vary widely, from as low as \$0.03 to as high as \$0.18 per kilowatt-hour (kWh). The bar graphs assume an electricity rate of \$0.10 per kWh. If your cost of electricity is different, use a simple multiplier to estimate your annual energy cost. For example, if the annual energy cost on the graph is \$8.00 per year and the electricity rates are \$0.03, \$0.06, or \$0.14 per kWh, the multipliers will be 0.3, 0.6 or 1.4 respectively. Thus annual electricity cost of the designs for those rates is \$2.40 ($\8.00×0.3), \$4.80 ($\8.00×0.6), or \$11.20 ($\8.00×1.4). Remember, though, that the annual lamp costs will not change.

Effect of Cost per Kilowatt-hour on Annual Operating Cost



Level of Effort and Annual Operating Cost Savings from Alternative Designs as Compared to Annual Operating Cost of Typical Designs



The average percentage reduction in annual operating cost for the 111 alternative designs compared to the typical designs is 47 percent. Annual operating cost savings increase as the level of effort required to install the alternative design increases. Generally, the least effort is required to replace a lamp. More effort is required to replace a luminaire or control. Remodeling and new construction require the most effort. The "Replace Lamps" alternatives save an average of 26 percent in annual energy cost compared to the typical designs. The "Replace Controls" alternatives save an average of 46 percent. The "Replace Luminaires" and the "Remodel or New Construction" alternatives save an average of 58 percent.