

# BEYOND BAD LIGHTING

Good design can **REDUCE COSTS** and **IMPROVE QUALITY**. So why is there still so much lighting that's mediocre – or worse?

Examples of poorly designed lighting systems abound. Some systems cause distracting and uncomfortable glare; others don't provide enough light, aren't energy efficient or are difficult to maintain. There are also systems that are over-designed and cost more than necessary. Oftentimes, poor lighting can have a long-lasting negative impact on a facility. Lighting that is aesthetically unpleasant, for example, can make it harder to lease space or can leave employees dissatisfied with their work environment.

Unfortunately, many of the issues related to good lighting are overlooked in the design of buildings. Too often, lighting is an afterthought or considered a small part of a mechanical-electrical system. That's true even though the return on the investment in good lighting design includes lower energy consumption and reduced maintenance costs. Better lighting might also result in more comfortable, satisfied workers.

So why are poorly designed lighting systems so common?

One reason is confusion about costs. There is often an assumption that better lighting has a higher initial cost. But that isn't necessarily the case. A poorly designed, inefficient light-

ing system may actually cost more because it uses more components than are necessary. What's more, it's possible to improve lighting quality without spending much money. One step lighting designers often recommend is replacing fluorescent lamps that have a low CRI, or color-rendering index (like cool white or warm white lamps), with lamps that have a high CRI. To see how effective that can be, a facility executive can install lamps with a high CRI of 80 in just one office or area of an office. People will see and appreciate the difference immediately.

The reason isn't simply that color will look better. A higher CRI improves visual acuity, depth perception and perceived brightness. When factors like those are combined with

more vivid colors, the space becomes visually more pleasant.

As that example suggests, lighting is a complex science in which an obvious solution isn't necessarily the right one. Consider an educational facility where occupants were complaining that there wasn't enough light. Because occupants could see items on their desks clearly, the problem wasn't illumination levels, so adding fixtures would have been the wrong thing to do. The problem was perceived brightness: The space had dark purple walls that made the lighting seem dim. What's more, the fixtures had T-12 lamps with high light-loss factor, so the light output fell significantly as the lamps aged. Because there was no group relamping policy, the space was



A redesign of the lighting prior to construction of the atrium at the Daimler Chrysler Technical Center in Auburn Hills, Mich., improved aesthetics and reduced costs by incorporating photocells to take advantage of daylight and by using newer lamp technology.

BY STEFAN R. GRAF AND SHARON STANCAVAGE



not getting quite as much light as called for in the original design.

Far from needing new fixtures, the facility had only to paint the walls a brighter color and to replace the lamps. In this case, better lighting actually costs less than the alternative. The new group relamping policy also cut operating expenses: The additional cost of replacing lamps before they burned out was less than the labor cost of replacing lamps one at a time.

Another option was to replace the T-12 lamps and magnetic ballasts with T-8 lamps and electronic ballasts. Doing that would have further improved lighting quality and cut operating costs, but at that point the school didn't have the funds for a retrofit.

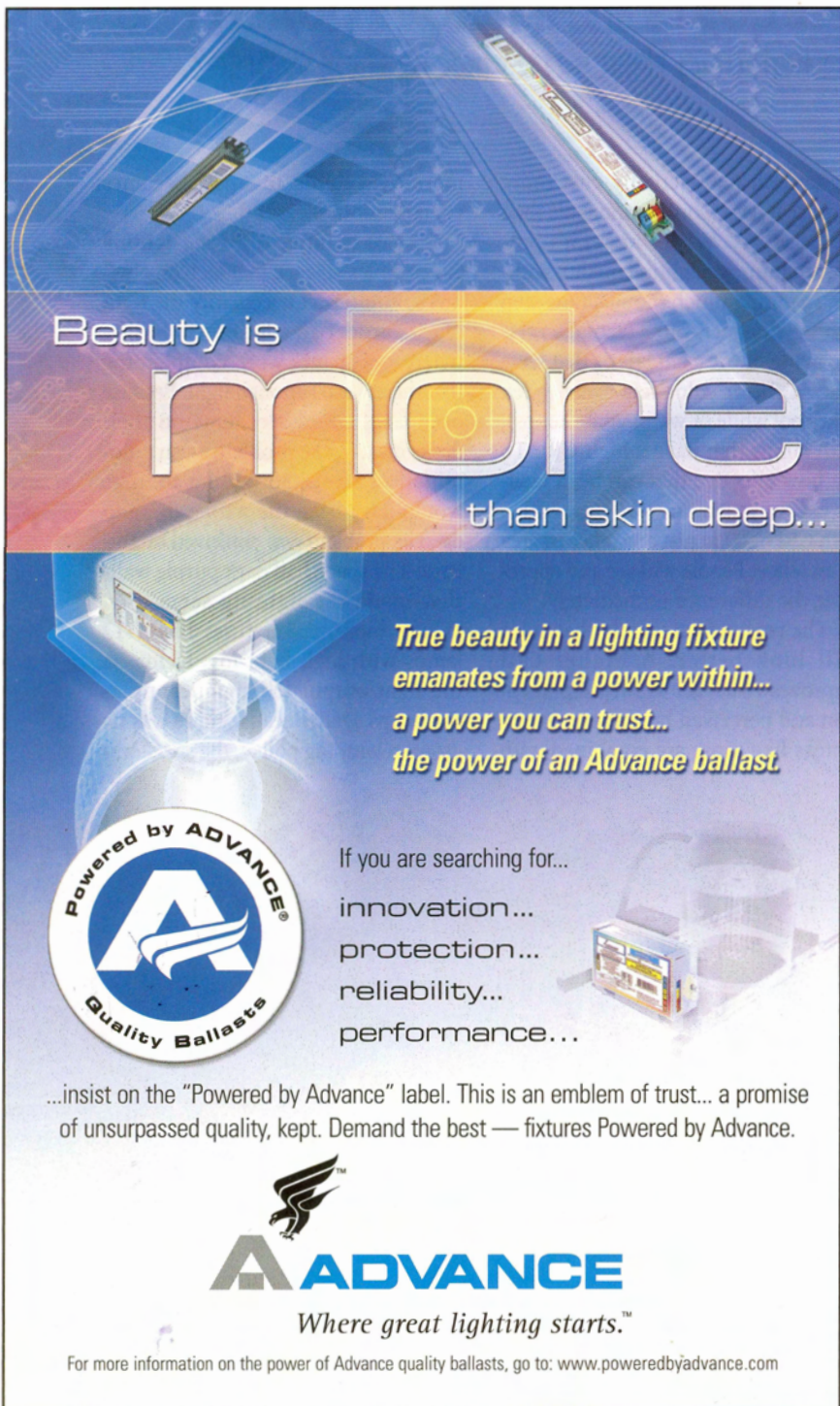
### RETURN ON INVESTMENT

Another cost-related misconception is that new technology is more expensive than old systems; however, the

opposite is typically true. New lamp, ballast and optical lighting systems may have a slightly higher initial cost, but they will pay for themselves quickly. In fact, a lighting system with new technology may cost 15 to 20 percent less to operate than one using four- or five-year-old components.

Of course, not every new technology is appropriate for every facility. Each design condition and component of a lighting system needs to be reviewed before it is specified for a project.

What's more, the mix of components must be carefully evaluated. For example, in a strategy known as whole-building lighting, components like photocells, automated shading systems, motion sensors and time clocks are combined with efficient fix-



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## **Lighting is a COMPLEX SCIENCE in which an obvious solution isn't always the right one**

tures and lamps to reduce operating costs. The entire system — carefully planned, designed and integrated — can provide a solid return on investment, largely by turning off lights when they're not needed.

Immense amounts of money are wasted each year simply because lighting systems have not been designed to work together. Think of the floors of office buildings with lights burning all night, or the spaces where electric lights remain on even though there is plenty of daylight in the space.

The process that best reveals the return on investment is a conservative life-cycle cost analysis program comparing a less expensive, less efficient system to one that uses new technologies. Depending on the scale of the project, cost savings between the lighting systems can differ by tens or even hundreds of thousands of dollars over the course of several years.

Of course, good lighting isn't



always about cash. Another reason that lighting design is given short shrift is that organizations don't realize the extent to which good lighting can benefit employees in the space, which can boost worker satisfaction and may increase productivity. The Light Right Consortium, which is affiliated with the U.S. Department of Energy, is the source of a variety of studies delineating the relationship between people and the quality of light in their work

environments. For example, a study titled "Lighting Quality and Office Worker Productivity" reports that workers who were satisfied with the lighting in their workspace rated that space as more attractive and were happier, more comfortable and more satisfied with their environment and their jobs. The same study indicated that when workers had individual control over their workspace lighting, their daily motivation increased, and their

individual work performance was sustained throughout the day instead of dropping, which is the norm.

Another industry study found that when individuals were given control over the lighting in their workspaces using a dimming control system, there was a 35 to 42 percent decrease in electrical consumption.

Other studies have found that headaches were reduced and task performance increased when energy efficient electronic ballasts were used in the workplace instead of magnetic ballasts. The reason: a reduction in the flicker and noise associated with magnetic ballasts. Of course, switching to energy efficient electronic ballasts not only

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## *It's important that ESSENTIAL ELEMENTS of a lighting design aren't compromised during construction*

reduces headaches, it lowers energy costs as well — another case where better lighting doesn't cost any more.

Overall, the Light Right Consortium has found numerous possible links between well-designed lighting and strategic business outcomes, including:

- Increased resale value of the property
- Enhanced ability to lease space
- Increased ability to attract and retain workers
- Improved employee mood, comfort and productivity
- Improved public image

### GETTING INFORMED

Although a facility executive doesn't have the time to become a professional lighting designer, it's worthwhile to invest some time in research before undertaking a lighting project. Education on the key issues surrounding lighting and implementation of better design and maintenance will give companies a competitive edge.

There are numerous educational





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resources on the Internet. (See box on page 50.) Magazines, trade shows and seminars are also excellent sources of information about lighting.

One of the biggest reasons to become more informed about lighting is so that the facility executive can have the design team and consultants address key lighting concerns. But before doing that, the facility executive should answer some pointed questions about organizational needs and priorities — answers that will help achieve the best design for the facility. Questions to consider include:

- Does the organization have the budget to spend a little more now (10 to 20 percent) to save much more in the long run — 20 to 40 percent each year for the next 10 years?
- How do the employees who use the space every day feel about the current lighting quality?
- To what extent is increased worker satisfaction important to the business?

• How important is it that the organization project an environmentally conscious image?

• Should daylight be integrated with electric light to reduce operating costs? If daylight is used, will glare be an issue for workers?

Getting answers to questions like these can help ensure that a lighting system meets the needs of occupants and stays within budget. But in many lighting designs such questions are never considered. And that fact points to a final but perhaps most important reason for poor quality lighting.

Many lighting systems are not designed for a particular space, organization, budget and group of occupants. Instead, they are produced using a cookie-cutter approach that may involve little more than picking fixtures from a catalog based on the number of footcandles required for the application. Many fixtures may look the same in catalogs but have different quality and performance characteristics. The cookie-cutter approach doesn't take into consideration issues like visibility, human per-

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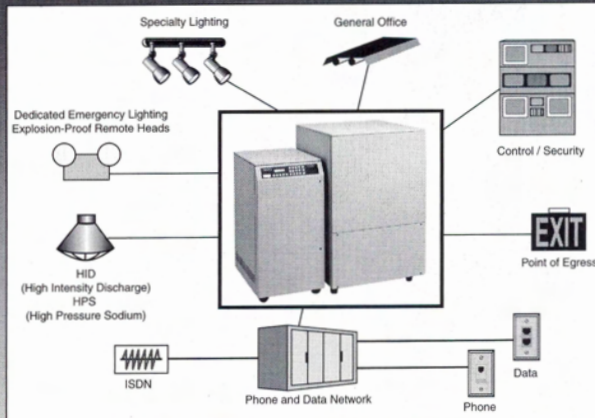
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formance or future maintenance, nor does it reflect what's new in equipment or techniques.

Such a system might be specified by an architect, engineer, interior designer or even a lighting sales representative. Lighting sales representatives may offer free specification services to customers, but the potential for conflict of interest is obvious.

## WORKING TOGETHER

A better approach is to use a design process that involves an independent professional lighting designer working closely with the facility executive, the human resources department and the architect or interior designer. The design process is based on the needs of the project and on up-to-date knowledge of lighting trends and technologies. The outcome isn't a list of catalog order numbers but rather a recommended plan and one or more options, with first costs and operating costs for each choice spelled out.

To see the difference between the two approaches, consider new open-

plan office space. A cookie-cutter design might call for indirect fixtures, lamps rated at 70 CRI, and 50 foot candles of illumination at the work surface. A better design, by contrast, might use direct/indirect fixtures to reduce energy use. Ambient lighting would be designed to provide 25 to 30 foot candles. Task lighting would supply the additional light needed on the work surface, reducing energy use and giving employees control over their own light levels. Lamps rated at 80 CRI would further improve lighting quality.

Another step would be to work

closely with the interior designer to ensure that the walls have a high reflectance value. That might make it possible to remove a row of direct/indirect fixtures and use wall washers to reduce first costs while providing bright space.

Once the design has been approved, it is important that essential elements not be compromised during value engineering or construction. The contractor must be brought onto the design team so that its personnel understand design rationale and strategies.

To control costs, unit pricing gathered during design development can be compared to unit pricing from the bidding contractors to spot gross anomalies. It may be advisable to procure additional competitive bids from distributors.

To ensure that all the benefits of an effective lighting design process are achieved, the facility executive should consider hiring an independent, full-time lighting designer to lead the process. That person should have credentials from an industry association like the IALD, International Association of Lighting Designers.

Lighting is an integral part of every building. When it's done well, it can be an economical asset that can reduce operating costs and increase employee satisfaction. Done wrong, it can be expensive, cause problems for staff and be an ongoing drain on the bottom line. **ECM**

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*E-mail comments and questions to [edward.sullivan@tradepress.com](mailto:edward.sullivan@tradepress.com).*

## For more information...

**There are many Internet sites with valuable information about lighting. Some of the best include:**

- International Association of Lighting Designers (IALD) at [www.iald.org](http://www.iald.org)
- Illuminating Engineering Society of North America (IESNA) at [www.iesna.org](http://www.iesna.org)
- National Lighting Bureau (NLB) at [www.nlb.org](http://www.nlb.org)
- Betterbricks at [www.betterbricks.org](http://www.betterbricks.org)
- The Lighting Research Center at Rensselaer Polytechnic Institute at [www.lrc.rpi.edu](http://www.lrc.rpi.edu)
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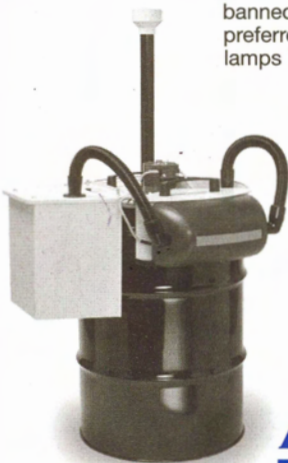
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