

# Commercial BUILDING PRODUCTS

SERVING ARCHITECTS, OWNERS, AND CONTRACTORS IN LOW- AND MID-RISE CONSTRUCTION

## Control Daylight, Save Money

A properly designed and tested daylight-control system can result in energy savings approaching 70% in most commercial buildings.



Commercial buildings are forced to face the high cost of energy every day. It's the nature of operating a business. Despite the fact that most lighting fixtures in schools, offices, and retail stores use energy-efficient fluorescent lamps, lighting remains the single largest source of energy consumption for these buildings, accounting for 35% to 65% of overall energy use.

The good news is that there are several ways to reduce and manage the amount of energy used by a facility, as well as the associated operating costs. One of the most effective strategies for achieving energy efficiency is to include a daylighting-control system into a building's plans.

Despite the high cost of energy, electric light typically is wasted by being operated at 100% of capacity all day, even when there is available sunlight to offset the need for full output. This is an extremely uneconomical practice, especially during peak hours when electricity and corresponding demand charges are high. Daylighting design takes advantage of the available sunlight, making it possible to reduce electric light levels and save energy.

Daylighting was once considered merely a method for bringing more sunlight into a building using architec-

tural features such as light shelves, large window-to-wall ratios, and skylights. Now, however, daylighting is more accurately described as a comprehensive design technique in which the goal is to create an efficient lighting system around the concept of incorporating as much daylight as possible, thereby reducing or supplementing the need for electric light. Effective daylighting systems today integrate with lighting control and controllable window systems to bring light into a building and to effectively manage that light.

### **Saving energy**

Sustainable design is no longer an option for many commercial projects—especially as green building codes and guidelines become more prevalent. The federal energy bill, passed by Congress and signed by President Bush on August 8, 2005, supports sustainable design by offering tax deductions for constructing energy-efficient commercial buildings. The legislation provides a tax deduction of as much as \$1.80/sq. ft. for new or renovated buildings that exceed the ASHRAE 90.1-2001 standard by 50%, with additional deductions for lighting, HVAC systems, and the building envelope. Lighting improvements alone can save building owners \$0.60/sq. ft.

California actually mandates the use of skylights and daylighting-control systems in single-story commercial buildings with a ceiling height greater than 15 ft. in the 2005 edition of Title 24, the state's energy code.

Retail buildings that incorporate high-performance designs and energy-efficient lighting systems can actually reduce energy consumption by 50%, when compared with conventional building designs, according to the U.S. Dept. of Energy. By effectively managing both sunlight and electric light, typically by integrating daylighting design with a quality lighting-control system, such as fluorescent lighting control with digital dimmable ballasts, facilities can save as much as 70% of current energy use.

### **Productivity and sales**

Beyond saving energy by taking advantage of available sunlight, facilities can actually improve productivity, satisfaction, and sales while improving the overall health and morale of the building's occupants.

Dozens of studies have confirmed that classrooms are more effective learning environments with greater amounts of daylight. Likewise, office environments and employee productivity have been shown to directly



improve with the proper balance of daylight and electric light in the workplace. Some studies show that bringing more daylight into retail stores has a positive effect on sales.

The cost of an employee (including salary, benefits, and overhead) far exceeds the energy cost in any building. That is why ergonomic lighting—lighting that is designed and installed in a way that considers the physical and psychological needs of the occupants—pays big dividends for companies today.

### **Integration**

Due to its remarkable evolution over the past five years or so, daylighting design has garnered much attention in the commercial-building arena. Effective daylighting systems today provide a comprehensive and integrated system for balancing building-wide efficiency by regulating an appropriate balance between natural and artificial light levels within the interior of a building.

Integrated daylighting-control systems consist of controllable lighting fixtures (such as dimmable fluorescent systems), motorized window covers, photosensors that measure light levels, and a lighting controller that adjusts electric light levels and the position of window

Integrated systems consist of controllable fixtures, motorized window covers, photosensors, and a lighting controller to adjust the components and maintain the prescribed light level.

covers to maintain the prescribed light level throughout the day.

A key element to system success is managing the proportionate levels of electric light output through a lighting-control system. To realize the full benefits of daylighting design, a quality lighting-control system must maintain proper illuminance levels by accurately adjusting the amount of electric light output in response to the amount of daylight measured by photosensors.

Not all lighting-control systems provide daylighting functionality, so it is important to research this in the initial design phases to avoid a costly mistake. Recent developments in fluorescent lighting control include digital addressable ballasts, a technology that facilitates daylighting and can provide easy installation and maintenance.

In fact, many commercial, retail, and education facility projects now are using fluorescent-based, lighting-control systems with dimmable digital ballasts that incorporate daylighting as part of the control system. Daylighting control zones are very often different from occupant control zones, and several zones with different light output requirements may be controlled using the signal from a single sensor. The result is superior performance and a high level of flexibility.

The immediate effect of bringing more daylight into a building is that window shading in some form or other is required to regulate heat and glare. Controllable window treatments provide a good solution to this, and also help to reduce the cooling load and protect interior surfaces from fading caused by UV and near-UV wavelengths. Controllable window coverings integrate with the overall system and are adjusted by a photosensor, typically placed on the ceiling one window height into the room from the window.

It is important to protect occupants from radiant heat and glare, which becomes uncomfortable and can reverse

the productivity-enhancing effects of natural light. Integrating controllable shades with the daylighting system helps maximize the efficiency, functionality, and comfort of the interior environment.

Another popular design technique is to integrate with a building-management system, providing a single point of control for all of the major building functions (HVAC, lighting, fire, and safety). As building-wide integration systems evolve, they are providing owners and managers with better energy control throughout a building. As part of this integration, daylighting design provides better lighting and the opportunity for even greater energy efficiency, than can be achieved with more conventional methods.

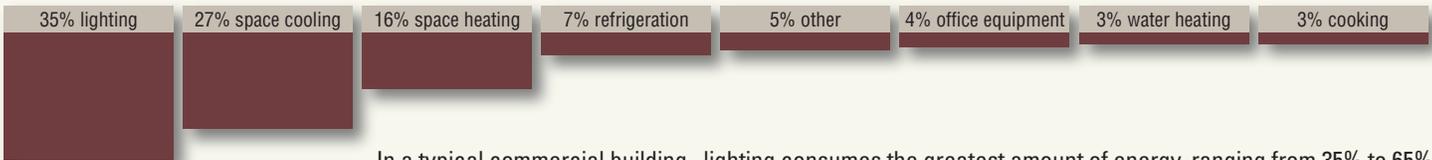
### **Designing for daylighting**

Effective daylighting system integration depends on the architectural features of a building, the interior design, exterior obstructions, and weather conditions. It is advisable to consider building exposures in the initial planning phase. The northern exposure frequently provides the best daylight source because all of the light is diffuse and relatively free from glare. The southern exposure, on the other hand, may need overhead shielding from high midday sun angles. East and west windows present a greater risk for direct sun glare. However, the glare usually can be effectively managed with motorized window coverings.

Daylighting needs to be adapted to the individual building features to achieve optimal performance. In addition, when designing a system, the sensor location is somewhat critical because it needs to accurately represent the incidental daylight that corresponds with the space. Typically, the sensor is located on the ceiling. In a working environment, this is usually above a desk. Photosensors should never look directly toward the building exterior because glare and direct sunlight can generate a false measurement.



Controllable window treatments regulate heat and glare and protect interior surfaces from fading.



In a typical commercial building, lighting consumes the greatest amount of energy, ranging from 35% to 65%.

When assembling a system, it is a good idea to test the design, either with a physical model or digital simulation. A lighting designer can also provide good insight and work with the architectural team to create an optimal arrangement and help reduce the chances of costly errors and omissions.

After implementing a daylighting system, commissioning is necessary to ensure that it functions properly. Once a complicated process, commissioning a system has been simplified in recent years. Manufacturers now offer trained technicians who know how to efficiently perform this job.

With the proper planning, a daylighting system can be very economical.

In some cases, initial costs will be higher than with conventional lighting systems but, by reducing the electric light output, and heating and cooling loads, the facility will realize lower long-term energy costs.

Automatic systems that switch off or dim the lights in response to daylight are highly effective in office, classroom, institutional, and retail environments. With the addition of controllable window coverings, energy savings could reach 70%.

Daylighting design is not just for new-construction projects. It can also effectively be retrofitted for existing buildings. In fact, most U.S. commercial buildings are candidates for daylighting integration. As more building owners demand high-performance designs that

promote productivity and energy-efficiency and meet various green building codes and guidelines, knowing the latest in daylighting and advanced lighting controls allows designers and contractors to provide an environmentally friendly, cost-effective, and high-performance facility.

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