BUILDING POWER

OCTOBER 2008
VOL. 1
NO. 1

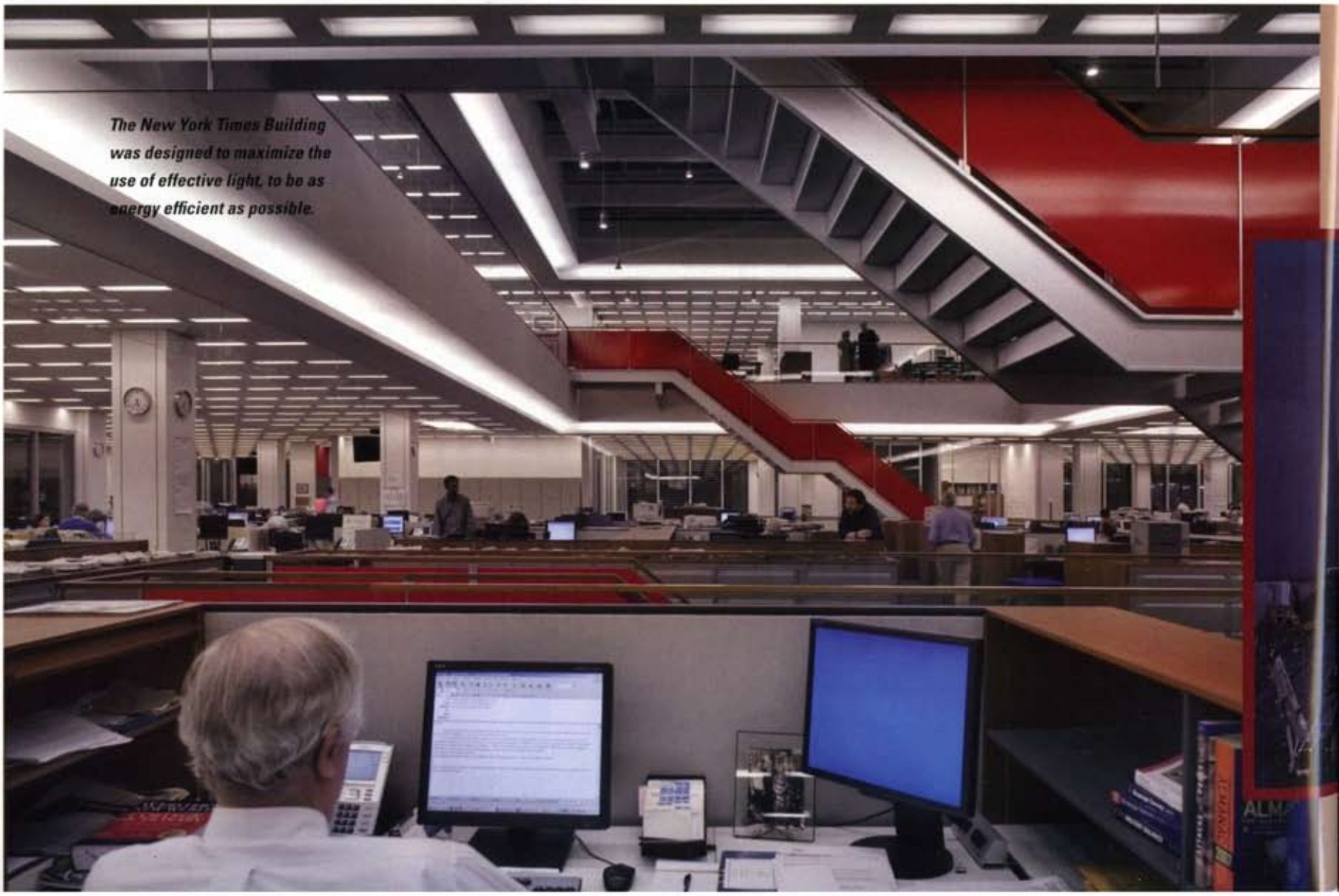
ENERGY SOLUTIONS FOR COMMERCIAL BUILDINGS

PREMIERE ISSUE

Total Light Control

School Daylighting

A supplement to Commercial Building Products



The New York Times Building was designed to maximize the use of effective light, to be as energy efficient as possible.

New York Times Writes Book on Total Light Control

Newly opened landmark building reduces biggest energy use with light-control measures.

• By Michael Jouaneh, Lutron Electronics Co. Inc. •

The rising demand and costs of energy and electricity are apparently here to stay. In fact, the U.S. Energy Information Administration (EIA), Washington, projects electricity consumption to increase 45% by 2030. Utilities are doing their best to keep electricity prices down by increasing capacity and providing energy-efficiency or demand-response programs to their commercial and residential customers.

Commercial building owners and facility managers can also do their part to address this problem by looking at their lighting energy usage first. Owners of a typical 50,000-sq.-ft. commercial building spend about $45,000/yr. on lighting energy.

Unfortunately, much of that money is wasted due to ineffective light control. In fact, most buildings today are considered over-lighted, for one of three reasons:

- there is enough daylight in the space
- lights are set to a higher level than appropriate for the people inside
- spaces are lighted even though they are unoccupied.

Lack of light control wastes energy, creates discomfort, and reduces productivity. Effectively controlling light in a building can eliminate 60% or more of those lighting energy costs.

Furthermore, according to the EIA, lighting alone accounts for the largest source of electricity consumption (44%) in commercial office buildings, and about 56% in education buildings. Lighting accounts for

Light-level tuning in the NYT building sets the appropriate target light level for each space.

Occupancy sensors turn off lights when no one is in a space, and dim lights when enough daylight is present.

considerably more electricity consumption than that of heating or cooling or any other building system. Therefore, whether retrofitting an existing building, or constructing a new one, managing light (electric light and daylight) is critical to reducing energy costs.

What is total light control?

Total light control is the ability of facility managers to manage and control electric light and daylight, including setting lights to any level including full-on or off. Electric light can be controlled with a combination of dimming ballasts, daylight sensors, occupancy sensors, and wall controls (dimmers or switches) that work together to maintain the correct light level for the various spaces in the building. Daylight can be controlled using automated window treatments that open or close at certain times to maximize the effective use of free sunlight while reducing heat and sun glare.

After all, other building systems, such as heating or cooling, are usually fully managed and controlled. For instance, facility managers can set and maintain different target temperatures for different spaces. However, up until recently, most buildings only feature simple light control (*i.e.* a standard toggle switch or occupancy sensor), giving occupants only two choices: lights full-on or off. Imagine if your building only had these two choices for the heating system. That would not be comfortable, nor would it save any energy.

Total light control not only saves energy, but also creates a more comfortable and productive working environment for occupants. For example, glare on computer screens from too much electric light or daylight can cause headaches and eyestrain, making workers uncomfortable and unproductive. Giving workers the ability to vary the light level eliminates glare and improves worker comfort and worker satisfaction.

Furthermore, research indicates that people are 4% to 7% more productive working in their preferred light level. That may not sound like a large amount, but it equates to 10 to 17 extra workdays/employee/yr. Based on an average office worker's salary, that's about $3,000 to $5,000/yr./employee. This savings is in addition to the energy savings from light control.

The New York Times Building

The New York Times Building in New York City provides a recent example of the energy savings achieved with total light control. This newly constructed headquarters for the The New York Times Co. is a dazzling Renzo Piano design, one chief aim of which was to maximize the use of effective light. The building, which opened in 2007, was designed to be as energy efficient as possible.

Following extensive testing of lighting control technologies at the Lawrence Berkeley National Laboratory, Berkeley, CA, The Times Co. installed the Quantum total light control system throughout its space. It was supplied by Lutron Electronics Co. Inc., Coopersburg, PA.

"The usage savings is stunning," said Glenn Hughes, director of construction for The New York Times Co. during the design, installation, and commissioning of the building. "We designed our building to use 1.28 W/sq. ft. of lighting power. With Quantum, The New York Times Co. is using only 0.38 W/sq. ft.—that's 70% less."

Seventy percent is a number that makes headlines. Hughes reports that other construction and lighting consultants are "astonished at the results." Through these energy savings, about 1,250 metric tons of CO_2 emissions will be prevented each year. In addition, it is estimated that this 70% savings in lighting energy usage will mean an annual savings of about $315,000 for the Times Co.

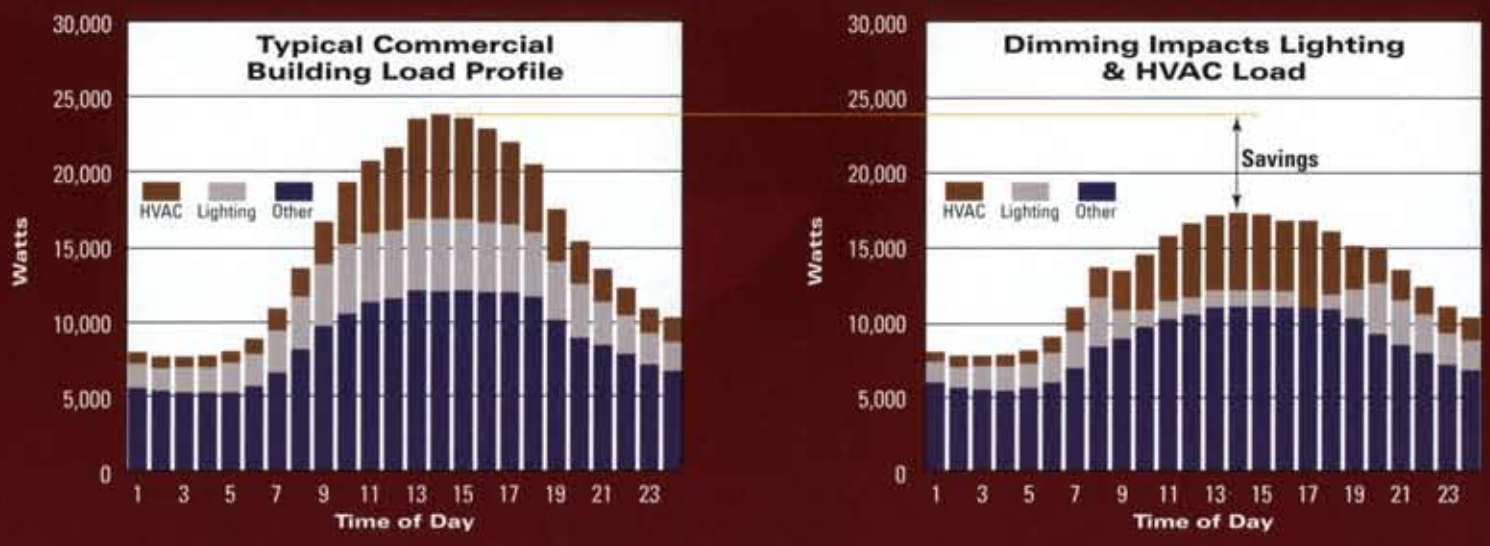
Light-control strategies

To achieve these dramatic energy savings, The New York Times Building used the following strategies:

- light level tuning (setting the appropriate target light level for each space)
- daylight harvesting (automatically dimming electric lights when enough daylight is present)
- occupancy sensing (turning lights off when space is

Dimming reduces HVAC load

Rule of thumb: 3 W of lighting saved = 1 W of HVAC saved



The graphs above show how dimming technology saves on lighting, and thus on the HVAC load.

vacant). Additional strategies can include:

- personal control (users selecting their preferred light level for their task at any given moment)
- load shedding (reducing lighting load at times of peak electricity pricing)
- scheduling (automatically turning lights off or to dimmed levels at certain times of day)
- high-end trim (setting the maximum light level in a space).

The combination of these strategies can save 60% or more in lighting energy, also reducing cooling energy. Typically, every 3-W reduction in lighting power eliminates 1 W of power for cooling.

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Addressable dimming ballasts

Until recently, office light fixtures were static, individual entities that didn't communicate with each other or with other building systems. They only turned on and off with the use of a standard toggle switch or with the help of a time clock or occupancy sensor.

Today, office lighting fixtures can listen and talk, to each other and to environmental sensors (*i.e.,* daylight sensors), and to other building systems. This has been made possible by digitally addressable dimming ballasts.

These advanced ballasts are equipped with a microprocessor, which provides them with decision-making capability, and component and system integration, right out of the box. There are roughly 18,000 digitally addressable ballasts installed in The New York Times Building, each providing immediate component and system integration.

With digitally addressable dimming ballasts, light fixtures become dynamic, fully adaptable, and adjustable (to any light level) entities networked with sensors, controls (occupancy sensors or wall controls), window shades, building management systems, and with each other for maximum energy efficiency, productivity, and comfort.

The impact of this newest technology for office lighting design means increased flexibility and simplified installation and use. By virtue of its plug-and-play capability, any combination of sensors or wall controls can be connected to the system's specialized ballasts, depending on the building or room's lighting requirements. Because there is no need for interfaces or power packs, sensors and wall stations can be removed or added with simple Class 2 wire connections at any fixture.

As an example, an occupancy sensor can be directly connected to a digital ballast for occupancy sensing. A daylight sensor works the same way. The new ballasts are fully scalable from small, stand-alone office spaces, to whole floors, to the whole office building or campus. Maintenance is also greatly simplified, as replacement daylight sensor works the same way. The new ballasts are fully scalable from small, stand-alone office spaces, to whole floors, to the whole office building or campus. Maintenance is also greatly simplified, as replacement ballasts speedily learn their programming when they communicate with previously installed digital ballasts.

The dynamic nature of these advanced lighting systems can keep pace with the dynamic nature of businesses themselves. As the lighting needs of a building change—because of new tenants or simply the movement of various departments of an existing tenant to different locations within the building—lighting zones can easily be reconfigured without rewiring, making a building adaptable to high churn rates. Wall controls, occupancy sensors, and daylight sensors can be reassigned to different fixtures or groups of fixtures very simply, without rewiring.

Controllable shading

Sunlight can be controlled through the use of another out-of-the-box solution: controllable shades. At certain times of day, shades can automatically raise or lower to reduce sun glare, solar heat gain, heat loss, light pollution, and HVAC load. According to a building simulation done by the TC Chan Center at the Univ. of Pennsylvania, Philadelphia, controllable window shades reduce solar heat gain by 10% to 30%, depending on the type of shade and glass properties, so less cooling energy is required during the warmer months. Controllable shades also reduce a building's heat loss by 3% to 29%, depending on type of shade, glass properties, and location. Therefore, less heating energy is required during the cooler months.

Using a combination of dimming ballasts, daylight sensors, and automated window treatments, an office can maintain the appropriate light level for each space, and effectively use the available ambient light to save energy and improve occupant comfort. For instance, electric lights automatically dim, without being noticed by the occupants, when enough sunlight is available. This maintains the necessary overall light level and maximizes the use of free sunlight. In addition, sheer window shades can automatically close at certain times to reduce glare and solar heat gain while maintaining the view.

level and maximizes the use of free sunlight. In addition, sheer window shades can automatically close at certain times to reduce glare and solar heat gain while maintaining the view.

Light control saves energy and money. Dimming lights saves considerable energy. For instance, dimming bulbs by a barely noticeable 25% saves 20% in electricity costs—and the more you dim, the more you save. When energy savings are paired with productivity gains, advanced lighting control systems pay for themselves quickly—typically in less than one year. A building owner or manager is left to ask, "Why continue to donate to the electric utility?"

The environment also benefits greatly from light control. Less use of electric lighting means less electricity will have to be generated. That means less fossil fuel will have to be burned and, therefore, less harmful CO_2 emissions enter the atmosphere.

It is in everyone's best interest to reduce electricity consumption, cut energy costs, increase worker comfort and productivity, and contribute to a cleaner environment. Total light control achieves those goals. BP

About the author

Michael Jouaneh is a marketing manager for Lutron Electronics Co. Inc., Coopersburg, PA. For more information about The New York Times Building project, visit www.lutron.com/nyt.