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Lighting up High Performance Buildings—

LIGHT MANAGEMENT BRINGS EFFICIENCY AND PRODUCTIVITY TO CUTTING-EDGE BUILDING PROJECTS

MICHAEL JOUANEH, LEED AP—MARKETING MANAGER, LUTRON ELECTRONICS CO. INC.

Electrical manufacturers, their representatives, and distributors are in the business of supplying buildings with the solutions that bring efficiency and value to the construction and operation of a facility. We support our customers by lighting the way toward a high performance building (HPB).

According to the U.S. Environmental Protection Agency, high performance building (also referred to as green building or sustainable building) is "the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction."

Furthermore, recent studies have shown that green buildings cost about the same to make as those built with conventional methods, but they can be significantly less expensive to operate in a climate of rising energy costs and limited resources. A 2008 report by the New Buildings Institute concluded that buildings that meet the U.S. Green Building Council's stringent LEED (Leadership in Energy and Environmental Design) requirements operate with 25 to 30 percent lower costs than than conventional buildings.

Numerous strategies must be combined to deliver a high performance building, but none is more powerful than a thoughtfully specified and commissioned

lighting control system. In fact, in many cases, managing lighting can save more electricity than any other commercial building system, because lighting accounts for more electricity use than anything else in a facility (according to the U.S. Department of Energy).

Unfortunately, much of that lighting energy is wasted. According to Stephen Selkowitz of the Lawrence Berkeley National Laboratory, "Most buildings don't deliver the right amount of light where and when it is needed. Lighting is often is often set at a 'worst case' level, which is usually higher than desired. And buildings seldom take advantage of daylight." What's more, many spaces are fully lighted even when they are vacant.

By managing light more effectively, HPBs not only stop wasting energy, they create a healthier, more comfortable, and more productive interior environment.

Lighting Control Strategies

There are a number of lighting control strategies at the disposal of building managers to maximize efficiency in their buildings:

ASTRONOMICAL TIMECLOCK SCHEDULING

Scheduling automatically dims or turns lights off at certain times of the day. Few buildings operate on 24-hour schedules, and many are empty during the overnight and weekend hours. Astronomical timeclocks can be used to provide a building lighting sweep at night so that lights are turned off or set to a low dimmed level at certain times, saving energy and preventing light pollution. Astronomical timeclocks are preferable to standard time-of-day timeclocks because they can automatically adjust lighting based on astronomical events such as sunrise or sunset, ensuring lights are not wasting energy when they don't need to be on. Scheduling can reduce lighting costs by 10 to 35 percent.

OCCUPANCY SENSING

Occupancy sensors automatically turn off as the result of inactivity. These sensors can reduce lighting/electricity use from 15 to 60 percent, depending on the use and size of the space. The latest sensor solutions use radio frequency (RF) technology, allowing them to be installed in minutes with no additional wiring and making them an ideal choice for retrofit applications. Occupancy sensors are best suited for private offices, conference rooms, restrooms, and classroom spaces.

DIGITALLY ADDRESSABLE DIMMING BALLASTS

Digitally addressable dimming ballasts are the building blocks of lighting systems that are fully controllable and scalable, from small stand-alone spaces to multiple rooms or areas, to whole floors, entire buildings, and even whole campuses. With digitally addressable ballasts, light fixtures can be directly networked with time clocks and occupancy sensors—not to mention daylight sensors, wall controls, handheld remote lighting controls, window shades, building management systems, and each other. Since they're digital, they can be easily reconfigured so that as spaces change, lights can easily be regrouped into different zones or to work with different sensors without rewiring.

Fluorescent luminaires that use these ballasts allow for light levels from 100 percent down to 1 percent of full light output, which allows for many energy-savings and productivity-increasing strategies (see below). What's more, digitally addressable ballasts allow users to monitor and report on the energy usage and functionality of each luminaire.

HIGH-END TRIM/TUNING

Lighting electricity usage can be reduced by 20 percent or more through high-end trim, which sets the maximum light level for each space. For example, the human eye can barely distinguish between a 100 percent light level and an 80 percent light level—but setting lights to 80 percent reduces energy use by about 20 percent. Light-level tuning sets the appropriate target level for each space, which is lower than the high-end trim level. So even when you employ high-end trim, many occupants prefer lower light levels to minimize glare on computer screens.

DAYLIGHT HARVESTING

Daylight harvesting automatically dims electric lights when enough daylight is present. A daylight harvesting system can typically save an additional 10 to 60 percent in lighting electricity costs in buildings with many windows or skylights.

PERSONAL CONTROL

Personal light control allows users to control general lighting directly over their workstations. The ability to vary lights to the appropriate level for the job at hand can improve productivity and reduce eyestrain and glare while saving energy. In fact, research by lighting expert Peter Boyce showed that "people with dimming control reported higher ratings of lighting quality, overall environmental satisfaction, and self-rated productivity." Lighting energy savings from personal control is usually at least 10 percent.

Using strategies like these in combination, it is typical for buildings to cut their lighting energy usage by 60 percent or more. Additionally, because lights emit heat, lighting control can reduce HVAC demand. As a rule of thumb, for every 3-watt reduction in lighting power, there is a 1-watt reduction in cooling load.

Real World Example: The Energy Foundation, San Francisco

Between daylight harvesting, high-end trim, and fine-tuning, the Energy Foundation saves a lot on their lighting bill. But to the staff, savings are just part of the story. The aesthetics, quality of light, and intuitive wall controls make their office a more attractive place to work.

"One of the nicest things about the workspace is the light here," said John Wilson, the foundation's buildings program director. "We get a tremendous amount of daylight, and that could be a problem if the accompanying overhead and task lighting wasn't handled properly—but a great deal of thought has gone into the light design. And because people can easily control their own lighting, they are very satisfied with their individual spaces."

Energy efficiency was core to the design of the new space. The design team set several goals for the renovation of the 17,600-square-foot space on the fifth floor of the historic Bently Reserve building in San Francisco. First, it had to be a showcase for energy savings, eligible for the highest possible LEED rating for commercial interiors. Second, it had to complement the "bones" of the building, using the existing structure to create an atmosphere of understated elegance. And finally, the space had to support open communication among foundation staff.

"Overall, we were looking to balance aesthetics, comfort, affordability, energy savings, and productivity. And key to doing all that was harvesting the daylight," said David Hecht, principal, Tanner Hecht Architects, the lead architect on the job.

The designers chose a modular fluorescent lighting control system that includes digitally addressable dimming ballasts, environmental sensors (occupancy and daylight sensors) and wall controls. Excellent as a standalone system, it also connects seamlessly to the light management system already installed in the Bently Reserve building as a whole.

"Every light is addressable by the system, which gives a building engineer the opportunity to individually adjust every single light," Hecht said. And that's exactly what Hecht did: he mapped out every single light source on a spreadsheet and a color-coded floor plan, and created a "light control intent" for the entire Energy Foundation space, with a goal of reducing overall lighting energy use by 45 percent. An optimal light level was set for individual spaces, using high-end trim to manage energy use. For example, walkway lighting was set at a maximum of 50 percent. Private office lighting ranged from 10 percent (for offices with windows) to 90 percent (for interior offices far from windows).

Occupancy sensors are used in conference rooms to make sure that lights are off when the room is unoccupied.

Thanks in part to the lighting control system, the Energy Foundation earned the highest possible LEED® certification for commercial interiors—LEED Platinum. And after eight months of operation, it had beaten the 45 percent lighting savings goal, too—with a 66 percent reduction in lighting energy use.