Lighting Controls: Options and Opportunities

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The Six Categories of Lighting Controls

When an institutional or commercial organization builds a new facility or renovates an existing one, occupants encounter a lighting system — including new lamps, ballasts, and controls — designed to be more energy efficient than the system it replaced. But whether the system actually performs up to expectations often depends on maintenance and engineering managers. The task for managers and their staffs is to oversee and operate these new systems efficiently and cost-effectively to provide as many benefits as possible to their organizations, including energy savings and reduced maintenance costs related to labor and parts.

Lighting controls offer an appealing array of opportunities. Lighting-control strategies fall into six categories: turning off the lights in unoccupied spaces; turning off or reducing output when daylight is available; reducing output in spaces with limited occupancy; reducing output when multiple uses require lower light levels; reducing lumen maintenance by tuning lights to less-than-full output when lamps are new and tuning higher as lamps age and output drops; and reducing the output based on need or personal preference.

Automatic Shutoff

Turning off lights is the oldest and most commonly used control scenario. The most efficient way to accomplish this goal is to train occupants to use the switch. But due to human error or inattention, energy codes require automatic solutions. In a commercial or institutional building with predictable, 24/7 occupancy, one solution is to install a low-voltage system that sweeps off lights at a set time after hours. Typically, an override is available for people who work late in these areas. For spaces occupants use intermittently, an occupancy or vacancy sensor provides more flexibility.

An occupancy sensor turns on lights when it senses motion and off when it does not. A vacancy sensor has a manual on and automatic off and provides greater reliability, meaning false-on triggering does not occur. It also provides higher energy savings because it prevents short-duration on-cycles.

This arrangement saves electricity and reduces on-off cycles that can shorten lamp life. Installers can mount sensors on walls or ceilings, or the sensors can be integral to the light fixture, which minimizes initial wiring costs. Wall sensors simply replace a wall switch, and ceiling sensors are appropriate for larger areas.

Daylighting and Dimming Strategies

Daylight is a highly desirable light source and provides opportunities for energy savings. When sufficient daylight is present, control systems can turn off or reduce lighting in steps or through dimming in a slow, continuous manner. Studies reveal occupants who are stationary and perform critical tasks, such as open offices, prefer dimming to happen slowly so they do not notice it. Stepped switching can be jarring and break a person's concentration, but it can work well in public-transition spaces, such as lobbies.

Not every light source is dimmable, so managers need to coordinate the lamp type with dimming options. The appropriate ballast or driver can dim most fluorescent and light-emitting-diode (LED) sources. Some metal-halide lamps are also dimmable, but they usually have a smaller dimming range with more color shift, so they might be inappropriate for some

spaces.

Technicians can install photocells on ceilings, walls, light fixtures or the building's exterior to control the flow of electricity based on the amount of daylight measured as reflected from task surfaces or entering the space at the daylight apertures, such as windows. Managers need to consider the location of photocells carefully to ensure they read the available daylight at a meaningful location.

Photocells also require calibration in the field to make sure they trigger lights at appropriate settings. Most products have factory presets, which technicians can adjust in the field or remotely, in the case of some digital control systems. Technicians also should test them periodically to see if adjustments are necessary.

Architectural Dimming

When a space has multiple uses, it often is desirable to have multiple lighting scenarios. A preset dimming system allows a manager to program several common lighting scenes, then make modifications for special cases without changing standard settings. This technology provides the flexibility to use only the needed lights at the appropriate intensity at a given time. These systems can be stand-alone or a larger system that links similar spaces.

Design Impacts Efficiency, Occupant Comfort

In certain applications, such as lobbies, corridors, and stairwells, lights must remain on for safety reasons, even when spaces are not occupied. Such spaces offer managers opportunities to reduce light levels and generate savings.

Consider an exit-stair area. Generally, a two-lamp fixture at each landing provides lighting in these areas. Since these are required exits, they usually have no switches, and the lights are on 24/7. Some fixtures use integral occupancy sensors to control one lamp in the fixture. For example, when the stair area is unoccupied, which is most of the time, only one lamp in each fixture is on. When a person enters the stairwell and triggers the sensor, the other lamp comes on.

Exterior Considerations

Increasingly, the idea of reduced light output is making its way to the exterior environment. Historically, options for exterior lighting control have been simply on or off, and they have used a photocell or timer control for automation. Today, some metal halide and LED sources are dimmable, so managers can set them at reduced output levels.

This strategy can offer significant benefits in parking lots, where reduced spot lighting can make an area feel unsafe. At times of low use, a uniform reduction in lighting is acceptable and results in significant energy savings.

Smart Design

For interior and exterior applications, an alternate strategy might be more effective and beneficial over the long term.

Designers intentionally overdesign most lighting systems so near the end of life, when the output of the source drops, the system continues to produce enough light.

Dimming the system when it is new can reduce the light to the desired level, and gradually increasing output over time maintains that level. Because the system remains dimmed for the duration of the time, the strategy saves energy.

Individual Control

In office spaces, studies reveal that if occupants can control their lights, they are more satisfied. They often set lights at less-than-full output, generating additional energy savings. In spaces that already feature photocell dimming, adding personal dimming is often a low- or no-cost benefit.

Virtual Controls

For large buildings, technicians can monitor a control system using a web-based program, allowing them to collect energy data and fine-tune lighting energy use. They can see if a room is occupied when not scheduled for use, get reports on components that need servicing, and see when the service is complete.

The programs reduce the need for random room checks and technician response time. The situation reduces maintenance costs and boosts user satisfaction because technicians can make repairs more efficiently.

Saving on Wiring

Wireless controls are available that further reduce the cost of implementing controls in an existing facility. Some even use kinetic — motion-generated — energy, which eliminates the need to replace batteries.

Wireless technology allows managers to implement occupancy-sensing controls and even photocells with little or no rewiring. This strategy is especially valuable in retrofits.

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