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Advanced lighting control can reduce operating costs

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Typically the largest electrical load in a commercial building, lighting accounts for 20 to 40% of the average business' electric bill. While light is a commodity essential for productivity, lighting is a business asset that should be managed as a critical component of both the building and the organization that occupies it. Generally, this entails investing in a good lighting design, which in turn utilizes the right lighting equipment, to maximize visual comfort while minimizing operating costs and carbon footprint.

Lighting systems use lamps and ballasts to produce light, and various controls to turn lighting on and off via switching and raise and lower its output via dimming. Basic controls - e.g., a simple wall switch - rely on human initiative. Automatic controls switch or dim the lights automatically in response to an input signal - e.g., programmed schedule, occupancy, available daylight - and thereby save energy by turning off or lowering lighting when it is not needed. Automatic shutoff controls are now a staple in new buildings because of energy codes, and daylight harvesting controls are now beginning to be required in some jurisdictions.

While automatic controls provide minimal compliance, they also present an opportunity cost due to their limitations. These systems have no centralized brain that allows deployment of advanced energy management strategies. They do not integrate well or share data with other building systems. The light fixtures are typically not individually controlled, limiting flexibility and future configurability by restricting zoning to lighting circuiting. Demand response cannot be achieved without turning off critical lighting. And it does not allow workers to control their own lighting.

When the digital revolution caught up to lighting control, advanced lighting control options became available that go beyond conventional automatic lighting control capability in terms of integration, flexibility and scalability. An advanced control system should offer:

* A choice of control method (dimming or switching) for different control tasks, enabling a complete offering of control strategies that go beyond energy code compliance;

* Individual control of light fixtures (via unique IP address), enabling greater flexibility and allowing workers to control their own lighting, a best practice demonstrated in research to improve worker job and environmental satisfaction;

* Ability to configure and reconfigure lighting control zones as space needs change using PC-based software, avoiding the cost of and hassle of rezoning by rewiring fixtures and controls;

* Central management capability with remote access, allowing facility operators to optimize the performance of the entire building (or campus) control system via software installed at a single workstation;

* Easy integration and data sharing (such as real time occupancy status) with building automation and other building systems, including capability to partner with utilities and implement a demand response program;

* Energy reporting that can be used for management, department billing, benchmarking and measurement and verification purposes; and
* Elegant equipment and wiring configuration enabling the above features and benefits - including lighting energy cost savings of up to 50-75% - to be economically achieved.

The advanced lighting control solution should be cost effective and easy to design/specify, install, use and adapt. Major advanced lighting control solutions include fabricated DALI-based addressable digital dimming systems and addressable digital dimming systems that use a proprietary manufacturer IO device. In either case, digital controllers are networked with controls such as switches, occupancy sensors, photosensors and compatible software using digital communication architecture. DALI offers multivendor interoperability but adoption has been severely limited. Proprietary approaches offer the advantage of the entire control solution being delivered by a single manufacturer, with assurance that all components will work together as specified, and with clear accountability and remedies if it doesn't.

Among proprietary solutions, there are two approaches. The point of control may reside in dimming ballasts or in relays distributed close to the loads they control. If the point of control is the ballast, an additional piece of equipment - the relay-based controller - is eliminated, but this type of solution is generally more expensive, as more expensive digital ballasts are required. If the point of control is a controller with one or more relays, three benefits are achievable that can increase cost effectiveness. First, the controller can be sized to the application - with one controller, for example, controlling all of the outdoor lighting as a group, with a series of small controllers dedicated to each indoor light fixture to provide individual fixture programming and control. Similarly, the ballast may be fixed-output or dimming, based on need, without being tied to dimming ballasts throughout the application. And finally, the controller may be able to work with off-the-shelf 0-10VDC dimming ballasts (and controls) from any reputable manufacturer, providing choice while reducing costs due to the lower price point of analog ballasts.

Advanced lighting control is the future of lighting and offers building owners and managers one of today's greatest opportunities for saving energy with better lighting.

CASE STUDY: Toronto General Hospital upgraded the lighting controls in its six-story 175,000 s/f R. Fraser Elliot Building, which houses the hospital's executive offices, administration, research facilities, food service and emergency medical services. The hospital's goals included achieving significant reductions in energy consumption and demand while maintaining light levels consistent with IES recommendations and providing personal control to office workers. The advanced lighting control system includes use of such strategies as smart time scheduling, occupancy sensing, load shedding, daylight harvesting, personal control and task tuning. IES light levels are maintained, and lighting quality is improved via the provisioning of personal lighting control; energy performance data was recorded as part of a measurement and verification commitment. The advanced lighting control solution reduced lighting energy consumption by 74% and power demand by 37%, generating annual cost savings of $0.45/s/f.

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