NETWORKED LIGHTING CONTROLS RESOURCES:

Lighting Controls Best Practices

As networked lighting controls (NLCs) become more common in commercial and industrial buildings, so do questions surrounding these systems and how to best use them to apply lighting control strategies.

The basic lighting control strategies of dimming, high end trim, occupancy/vacancy sensing, scheduling, and daylight harvesting are not new to commercial and industrial buildings or unique to NLC systems. However, the advanced technology of NLCs allow for far more flexible implementation on projects than legacy systems. Let's go through each strategy one by one.

HIGHLIGHTS

- Describes five basic networked lighting control strategies: dimming, high end trim, occupancy/vacancy sensing, scheduling, and daylight harvesting.
- Explains how to apply each strategy effectively to maximize energy savings.

Dimming

Dimming is the process of incrementally reducing the light output of a fixture to produce a smooth visual transition. This has the effect of reducing the energy consumption of the fixture by roughly the same amount as the reduction in light output. Dimming is a foundational control strategy that enables other energy saving strategies like high end trim, daylight harvesting, and demand response. Luckily, dimming is also the easiest strategy to implement: over 99% of the fixtures on the DLC's SSL (LED) Qualified Products List (QPL) are capable of dimming, and every NLC system on the NLC QPL supports dimming. That said, not every dimmable fixture is compatible with every NLC system. The best way to ensure compatibility is to test the actual products with a mockup. If a mockup is not possible, check with the fixture and controls manufacturers for guidance.

Dimming is particularly easy to implement when you choose Luminaire Level Lighting Controls (LLLC) for your project. With LLLC, every fixture comes from the factory with both a networked dimming controller and a sensor on board. Simply wire the fixture for power. No additional low-voltage wiring is required! From there, activating dimming is usually a simple toggle in the system programming interface. Once dimming is enabled, you can move on to high end trim.

Takeaway: Dimming is easy to implement, necessary for other control strategies, and comes standard on the vast majority of light fixtures.

High End Trim

High end trim, sometimes referred to as 'task tuning', is the process of setting the maximum light level that the space occupant or everyday user can access. For example, many new LED fixtures are significantly brighter than the fixtures they are replacing. To accommodate this, the maximum end user accessible light level may be set at 70% or 80% of the maximum fixture light output, enabling energy savings of 20-30% *without the end-user even noticing*. There are many considerations that go into choosing the ideal level of high end trim on a project, so be sure to check IES guidelines for minimum light level recommendations for each application. The IES Lighting Ready Reference App is a great place to start.

For most incentive programs, enabling any level of high end trim is enough to count the strategy as implemented, but the ideal high end trim range is usually 60%-80% of total light output. Levels of less than 60% indicate that a less powerful fixture might be more appropriate for the application.

Takeaway: High end trim saves energy without the end user noticing. The ideal range is 60%-80% of the total light output of a fixture.

Occupancy/Vacancy Sensing

Occupancy/vacancy sensing is the process of using devices that detect human presence (occupancy), or the absence of human presence (vacancy), to turn on or off the lights in a space. These devices can be stand-alone, ceiling, or corner-mounted units, integrated into fixtures, or integrated into a wall box control station. Most modern sensors, both stand-alone and part of an NLC system, are capable of both auto-on/auto-off (occupancy) and manual-on/auto-off (vacancy) operation.

One advantage of NLC-incorporated devices is that they enable sensors to be grouped together in software, thus providing better sensor coverage for a given room than stand-alone sensors. In occupancy mode when the lights are off, a single sensor that detects human presence will trigger all the lights in the group to turn on. Conversely, in occupancy or vacancy mode when the lights are on, all the sensors in the group need to register no human presence for a given period of time before the lights will turn off. The ability of networked sensors to communicate and share presence information helps reduce false off events where lights turn off unexpectedly when a space is occupied. This level of performance is not possible using stand-alone non-networked sensors.

Implementation of occupancy/vacancy sensing is largely driven by the various energy codes that apply to most projects. Both the ASHRAE 90.1 and IECC codes specify occupancy or vacancy sensing by space type, and many versions call for a maximum timeout length of 20 minutes. In some space types, such as restrooms and stairwells, timeout lengths longer than 20 minutes can greatly reduce energy savings. If a property owner requests extended timeout lengths, they should be made aware of the impact it might have on the overall energy savings of the project.

Takeaway: Occupancy/vacancy sensing turns the lights off when people aren't around. NLCs allow sensors to be grouped together to reduce unexpected lights off events.

Scheduling

Scheduling is the process of turning lighting on or off according to predetermined times of day or night. For many projects, scheduling can be used as a backup for when other strategies encounter problems. For instance, sometimes environmental factors (such as shadows caused by passing car headlights at night) can cause false triggers for occupancy sensors. With scheduling, a project can compensate for problematic sensors and still achieve energy savings. The details of each implemented schedule will vary due to project location and client needs. The best practice for implementing scheduling is to sit down with your client and have a detailed conversation about their needs and operations for each location and use that information to develop lighting schedules. Requirements may vary, but most incentive programs just need to see that a schedule is documented and enabled to count this strategy as implemented.

Takeaway: Scheduling can overcome challenges with other strategies. Have a detailed conversation with your client to customize lighting schedules to their needs.

Daylight Harvesting

Daylight harvesting, also known as daylight dimming, or simply daylighting, is the process of lowering electric lighting levels in response to available natural light from a window or skylight, with the goal of maintaining a steady minimum light level. Most energy codes have very specific formulas dictating which fixtures must be set for daylight harvesting based on their proximity to windows and skylights. For many retrofit projects, this level of analysis of a space is out of reach, limiting the effectiveness of the strategy.

Luckily, the sensors used in most LLLC style systems are capable of both human presence and light level detection. So, for an LLLC project, if a space has a window or skylight, it makes sense to implement daylight harvesting for all fixtures in that space, regardless of where the fixture is located. If the sensor detects enough natural light, it will dim down while that natural light is available. When the natural light goes away, the fixture dims up to reach the target light level. When implemented correctly, the occupant won't even notice the change.

For all lighting control systems, daylight harvesting needs to be calibrated in some way to work properly. Some systems have a self-calibration feature while others require the use of a light meter and manually entered values. Be sure to check with the system manufacturer for calibration procedures.

Takeaway: For LLLC style systems, daylight harvesting can provide additional energy savings with minimal extra investment. Be sure to follow the proper calibration procedures from each system's manufacturer.

The five basic lighting control strategies described above are required by most NLC incentive programs for commercial and industrial buildings. These strategies have been proven to save energy while still providing appropriate light when needed. Be sure to use them on your next project to maximize your client's lighting energy savings.