Revolution in Light
EXECUTIVE SUMMARY

The lighting industry is undergoing massive change due to growing demand for intelligent LED lighting systems and controls. LED lighting, which promises high operating cost savings, is ideally paired with intelligent lighting controls, which promise additional savings and flexibility. Accelerating demand for these technologies is transforming workspaces while reducing costs.

- Global demand for LED lighting is expected to grow 45 percent per year (Radiant).
- Demand for LED lighting is driving demand for intelligent lighting controls.
- Intelligent lighting controls promise programmable networked lighting that is superbly flexible, responsive and produces high energy savings.
- Many new LED light fixtures are packaged with intelligent lighting controls, often with radio-frequency (RF) wireless connectivity.
- Combined, common lighting control strategies deliver an average 38 percent energy savings.
- The DesignLights Consortium now recognizes networked lighting controls in its Qualified Lighting Products, making them eligible for utility rebate programs.
- Global demand for lighting controls is expected to double from 2015-2020 (McKinsey).

Growing demand for lighting controls is creating an education gap among lighting service providers unfamiliar with aspects of the technology. Misapplication and improper installation can result in poor performance, user complaints and lower than expected energy savings. The electrical industry has responded with a series of initiatives, including a new Certified Lighting Controls Professional (CLCP) designation developed by the interNational Association of Lighting Management Companies (NALMCO).

- The CLCP is a certification open to the electrical industry and based on 60 hours of online education developed by the Lighting Controls Association.
- Certification demonstrates baseline of proficiency in lighting controls technology, application, design, commissioning and related issues such as energy codes.
- Developed by NALMCO, which has represented the lighting management industry for more than six decades.

This whitepaper advises commercial building owners and managers that accelerating demand for LED lighting and lighting controls, particularly intelligent controls, is creating an education gap. To manage risk, they should seek qualified providers of design consultation, product selection, installation, commissioning and maintenance services. Certification is an important qualification demonstrating proficiency in vendors performing lighting upgrades.
THE COMING LED RETROFIT WAVE

According to the Department of Energy (DOE), the U.S. commercial building stock includes more than 87 billion square feet residing in 5.6 million buildings.

In nearly 30 percent of these buildings, lighting upgrades have been undertaken. An upgrade involves replacing components in existing light fixtures or replacing the fixtures to reduce energy costs, improve aesthetics/visual comfort or both.

The predominant light source in commercial buildings is fluorescent. LED lighting alternatives are now available for virtually every lighting application. These alternatives offer equivalent or superior lighting performance while reducing energy costs by 50-80+ percent. Offering service life of 15,000+ hours for lamps and up to 100,000 hours for light fixtures, they may also reduce maintenance costs.

According to major manufacturers, LED lighting is already predominant in light fixture sales to new construction projects. In tandem with LED sources and fixtures improving in performance, costs are steadily declining, making LED very attractive for upgrades. It is speculated that LED fixtures may serve as a delivery platform for sensors enabling the Industrial Internet of Things.

As a result, DOE anticipates adoption of LED lighting—currently estimated at about 3+ percent of all lighting installed in the U.S.—to grow rapidly. According to Radiant Insights, the global LED lighting market is expected to grow 45 percent per year through 2020, reaching $63.1 billion by 2020. In a 2012 NALMCO survey, members reported that while only 13 percent of their lighting upgrade projects utilized LED lighting that year, they expected 84 percent of their projects to utilize LED by 2018.

A major driver in growing demand for LED lighting is utility rebates. About two-thirds of the United States is covered by prescriptive lighting rebates offered by utilities and energy efficiency organizations, according to BriteSwitch. These rebates reduce the installed cost of new lighting and can improve payback by 20-25 percent, which would reduce a two-year payback to about 1.5 years. Many utilities qualify LED products by requiring listing with the DesignLights Consortium’s Qualified Products List, which currently lists more than 175,000 LED products.
According to the U.S. Department of Energy (DOE), LED lighting is expected to become the predominant light source in the United States by 2030. Image based on forecast data produced by the DOE.
THE COMING WAVE IN LIGHTING CONTROLS

Lighting controls are systems and devices that respond to an input signal by changing the power state of a lighting system. The goal is energy savings, visual needs or both. The control input is manual or automatic, and the control output is dimming or switching. Automatic energy management controls respond to one of the following inputs:

• **Occupancy:** This strategy may be implemented using occupancy sensors, devices that reduce lighting based on whether occupancy is detected in a space. It is ideally suited to smaller, enclosed spaces. According to a Lawrence Berkeley National Laboratory (LBNL) meta-analysis based on a review of 88 case studies and research projects, this strategy generates 24 percent average lighting energy savings.

• **Time:** This strategy may be implemented using time switches (devices that reduce lighting based on a schedule) or a signal from another control system such as a building automation system. It is well suited to control of larger loads such as public spaces. LBNL estimates 24 percent average lighting energy savings.

• **Daylight:** This strategy may be implemented using photosensors, devices that measure light falling on the sensor. As daylight increases, connected photocontrols reduce the lighting to save energy. It is ideally suited to spaces receiving high, consistent daylight. LBNL estimates 28 percent average lighting energy savings.

• **Manual input or high-end trim:** Task tuning involves either manual lighting reduction or automatic lighting reduction via a cap on maximum light output. Manual control may be implemented for individual users or group spaces. High-end trim may be implemented for individual spaces that are overlighted. LBNL estimates 36 percent average lighting energy savings.

• **Multiple strategies:** LBNL estimates that combining the above strategies can produce 38 percent average lighting energy savings.

Intelligent lighting control incorporates decision-making into the control solution via one or more microprocessors. The microprocessor may reside within each device (distributed) or in a central location (centralized). The present algorithm allows programmability of the control system. For example, an occupancy sensor set with a 15-minute time delay during the day can automatically reset to a 5-minute time delay after normal operating hours, increasing savings.

Devices and light fixtures may be connected using digital low-voltage wiring or RF wireless signals, creating a network in which each device has a unique address.
Global market size of building wireless lighting controls, 2013-2020 (in millions of dollars). The global value of intelligent lighting control products is forecasted to grow at a compound annual growth rate of 12 percent through 2020, according to Memoori. Wireless control, estimated at 10 percent of the intelligent lighting market in 2013, is forecasted to grow at a CAGR of 30 percent and achieve a 23 percent market share by 2020. Image courtesy of Memoori.
Combined, these capabilities enable economical layering of control strategies, scalability, very small control zoning, software-based rezoning, and potentially data that can be used for energy management. The result is extreme flexibility, decision-making, information, and typically higher energy savings.

New construction requires a sophisticated level of lighting control, but lighting controls are less common in existing buildings, with adoption concentrated in larger buildings. Intelligent lighting control currently has an estimated penetration of about 2 percent of the installed lighting base, according to Navigant Consulting. Demand for lighting controls, particularly intelligent controls, is expected to grow rapidly, driven by two factors.

First is accelerating adoption of LED lighting. LEDs are inherently controllable. The light source is instant-ON, and frequency of switching has a negligible impact on service life. A majority of LED fixtures are available with dimming standard or as a standard option. As digital devices, they are inherently compatible with intelligent networked lighting controls. Numerous fixtures by a wide range of manufacturers are available packaged with intelligent controls. Additionally, controls enable new capabilities created by LED, such as tunable-white lighting.

As with LED lighting, utility rebates are expected to be a major driver for demand of lighting controls. Lighting controls such as occupancy sensors and daylight harvesting dimming systems continue to be included in the large majority of prescriptive rebate programs. In contrast with other technologies, average rebate dollars have remained somewhat stable, declining just 10 percent over the past five years. Average rebates cover a significant portion of the installed cost.

Additionally, in May 2016, the DesignLights Consortium created a Qualified Products List for networked lighting controls, which will facilitate recognition of these control systems in utility rebate programs. Regulators are increasingly tasking rebate program managers with achieving energy savings beyond minimums mandated by energy code baselines, so they are focusing on higher-efficiency LED lighting and networked lighting controls. These rebates are expected to significantly reduce the cost of intelligent lighting.

According to McKinsey, global demand for lighting controls is expected to nearly double in the next five years with an 18 percent CAGR compared to less than 5 percent for general lighting during the same period. McKinsey estimates that global demand for lighting controls will reach 7.7 billion euro by 2020. Research firm Memoori forecasted that intelligent lighting control products will grow at a CAGR of 12 percent through 2020, with wireless intelligent lighting controls surging at a high CAGR of 30 percent to reach some $1 billion in global sales.
EDUCATION GAP

Accelerating demand for LED lighting and lighting controls is pressuring the lighting channel to increase its capabilities, especially in regards to controls. Of heightened interest is:

• **Consultation**: Commercial building owners need expert advice on product selection. Many lighting controls, particularly networked lighting controls, are not standardized. Many configurations and feature sets are available. These configurations and features must be properly matched to the application needs and the ability of the owner to operate and maintain them. Integration issues between systems must be resolved.

• **Installation**: Lighting controls must be properly installed. Improper installation remains unfortunately common, resulting in operating problems even if the control system appears to be functional. Deviations can result in poor control performance that can generate user complaints and lower than expected energy cost savings.

• **Startup/Commissioning**: New lighting control systems must be calibrated and tested to ensure conformity with manufacturer instructions, the design intent and owner project requirements. As with poor installation, a lack of commissioning can result in user complaints and lower than expected energy cost savings. In 2009, LBNL conducted a study involving commissioning and retro-commissioning. They found a significant number of lighting deficiencies; 25 percent of the existing and more than 35 percent of the new buildings they included in the study. As an isolated measure, addressing lighting deficiencies was found to produce a 1.4-year payback. As an indicator of commissioning’s importance, it is required by the latest generation of commercial building energy codes.

• **Maintenance**: As with any other lighting equipment, lighting control systems must be maintained. It is recommended that the system owner perform periodic inspections and re-aim, recalibrate and reprogram sensors and controllers as needed.
The electrical industry launched three initiatives to improve channel expertise with lighting controls:

• **CALCTP:** The California Advanced Lighting Controls Training Program (CALCTP) is an ongoing program providing training in lighting controls to electrical workers and contractors. This program has been expanded to include other states such as Illinois and Washington, and is expected to be rolled out in Canada.

• **CALC:** The DesignLights Consortium is developing a training program to support its members and other utilities implementing rebates based on its new Qualified Products List for Networked Lighting Controls.

• **The Lighting Controls Association:** An association of lighting manufacturers, the Lighting Controls Association provides free public education about lighting control technology and application.

To date, none of these organizations has developed a national certification signifying a high level of general expertise in lighting controls technology, application, design and commissioning. Recognizing the growing importance of lighting controls, NALMCO developed the Certified Lighting Controls Professional (CLCP) designation.
CERTIFIED LIGHTING CONTROLS PROFESSIONAL

Founded in 1953 as the voice of the lighting management industry, NALMCO represents 99 companies that provide lighting maintenance, lighting upgrades and lighting and sign repair services to commercial building owners and managers. These companies, located in 39 states, Puerto Rico and Canada, generate an estimated annual $1.1 billion in revenues and purchase $400 million in electrical products and material in 2012. They employ more than 4,300 workers and operate a fleet of some 1,800 service vehicles. According to a 2012 NALMCO member survey, lighting upgrades performed by members reduced energy consumption by more than 2.6 billion kWh that year.

Aside from the CLCP, NALMCO administers four certifications:

• Certified Lighting Management Consultant (CLMC), demonstrating proficiency in lighting management;
• Certified Sustainable Lighting Consultant (CSLC), demonstrating proficiency in lighting energy management; and
• Certified Senior Lighting Technician (CSLT) and Certified Apprentice Lighting Technician (CALT), demonstrating proficiency in providing lighting management services at the jobsite.

NALMCO subsequently developed the CLCP to support its membership and strengthen their services and competitiveness in a growing market for lighting controls. The CLCP is based on the education curriculum developed by the Lighting Controls Association’s Education Express online education system (LightingControlsAssociation.org)

Education Express courses comprehensively cover lighting control strategies, technology, application, upgrades, energy codes, design and commissioning. Combined, they represent approximately 60 hours of learning. Courses are registered with the American Institute of Architects (AIA), National Council on Qualification of the Lighting Professions (NCQLP) and CALCTP/NALCTP.

Each learning module tests student knowledge with an online exam. To earn the CLCP designation, the professional must successfully pass all online exams and then pass a master exam developed by NALMCO.
Demand for LED lighting and lighting controls is steadily increasing. As lighting and controls become increasingly complex, commercial building owners and managers require professionals that can provide installed systems that are reliable and perform as specified.

NALMCO’s CLCP designation, available to the electrical industry, offers assurance that a professional is highly educated about lighting controls based on a high-quality curriculum designed by the controls industry. This ensures that correct strategies are deployed in the right spaces, optimal solutions are designed, all equipment is properly installed and commissioned, and that all equipment will perform as needed throughout its life.

To learn more about the lighting management industry and the CLCP, visit NALMCO.org.