



Seattle City Light

# NETWORKED LIGHTING CONTROLS TOOLKIT

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# NETWORKED LIGHTING CONTROLS TOOLKIT

Are you a customer interested in leveraging advanced or “smart” control technologies for your lighting project? Are you a contractor or vendor that is considering networked lighting controls, including luminaire level lighting controls, for your next project? Use this toolkit to learn more about the benefits of this technology and share individual resources with stakeholders on your lighting project to increase energy savings, occupant comfort, and lighting system flexibility.

## How to use this toolkit

This toolkit was developed for users to pick and choose which individual pieces or sections best meet their needs. You can download the entire toolkit, or you may decide to grab one of the resources to share with your project stakeholders—building owners, tenants, installers, designers, engineers, commissioners, building operators, etc. Networked lighting controls have broad benefits that can be maximized when all project stakeholders understand the project’s goals and the technology’s role in meeting those goals. This toolkit can help with that!

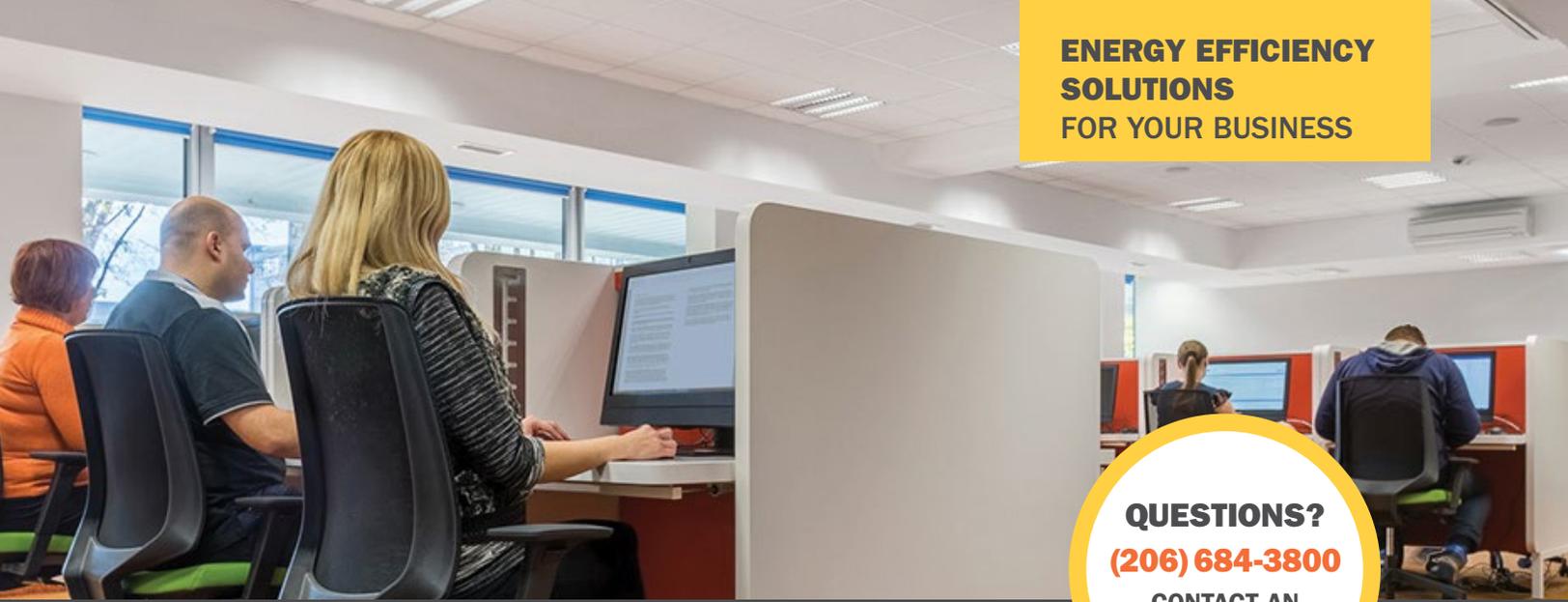
Looking for Seattle City Light financial incentives for networked lighting controls? Visit this page: [seattle.gov/city-light/business-solutions](http://seattle.gov/city-light/business-solutions)

## What’s in this toolkit

The toolkit’s resources are organized into sections starting with general overview information and ending with more specific educational resources.

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# GENERAL INFORMATION



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## NETWORKED LIGHTING CONTROLS

Networked lighting controls (NLCs) combine LEDs, controls, connectivity and data for a flexible lighting system that can improve occupant comfort and space utilization. NLC controls strategies include occupancy sensing, daylight harvesting, continuous dimming and more.

### The benefits

#### 1) Easy installation and use

Fixtures can be ordered from the manufacturer with the sensors and control programming integrated into the fixture, so set up is easy out of the box. Many products allow remote programming and control through an app or tablet. Available LED retrofit kits make this a simple install for those with existing linear fluorescent fixtures.

#### 2) Long-term flexibility

Adaptable for changes in space usage, fixtures with NLCs reduce the cost of changeover to new tenants. Simply regroup to the new lighting layout and adjust settings for new tenants.

#### 3) Energy cost savings

NLCs use 25 to 50% less energy than non-controlled fixtures.

#### 4) Better occupant experience

The right amount of light provides occupants with a better environment for increased productivity.

#### 5) Additional benefits

Some systems are more comprehensive and enable valuable benefits such as asset tracking, space utilization, enhancements to safety systems and much more.

### Availability

For the DesignLights Consortium® Qualified Products List, visit: [designlights.org/lighting-controls/download-the-qpl/](https://designlights.org/lighting-controls/download-the-qpl/)



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# SMARTER CONTROLS, BIG BENEFITS

## Simple Installation

Sensors and control programming can be integrated into fixtures for straightforward setup out of the box.



## Occupant Comfort

With the ability to adjust fixtures individually or as a group, NLCs boost occupant comfort and productivity.



## Flexible Control

Adaptable for changes in space usage, NLCs reduce cost of change-over to new occupants.



## Savings

Energy savings of 25 to 75%, and decreased installation and maintenance costs.



## Better Lighting

Overall light quality is improved with LED and sensor light fixtures.



## Building Improvement

NLCs can enable emergency lighting, demand response, asset tracking and integrate with other building systems.



Combining LEDs with controls and sensors, NLCs offer a solution that will improve buildings, deliver maximum energy savings and enable long-term flexibility.



# NETWORKED LIGHTING CONTROLS

## FAQ

Networked lighting controls (NLCs) are lighting systems with wirelessly networked integrated sensors, enabling luminaires within the system to communicate with each other. These systems provide multiple control capabilities in one package, from occupancy and vacancy sensing to daylight harvesting and data transmission, as well as combinations of each.

### Why are NLCs the future?

- **Strong savings potential:** Preliminary estimates show **25 to 50 percent** savings compared with non-controlled fixtures.
- **Simpler lighting path:** NLCs address limitations of earlier generations of controls:
  - Some systems have pre-programmed settings to offer a better out-of-the-box experience.
  - Less wiring.
  - Same basic installation process as non-controlled fixtures when using luminaire level lighting controls (a subset of NLC systems).
  - Wireless features and apps ease the programming process.
  - Finer tuned controls offer a better customer experience, such as daylight harvesting for even space lighting and continuous dimming, which allows dimming over a continuous range, as opposed to step-dimming which only allows for preset increments between off and full output.
  - Sensors and software work together to adapt to the space and can be individually controlled via smartphone or tablet, making it easier to reconfigure as needs change.

### When is a NLC system right for my customer?

For all building types, today's NLC systems provide the best light quality and most aggressive energy savings currently on the market. They also provide a simple path to multiple control capabilities including:

- **Occupancy and vacancy sensing**
- **Daylight harvesting**
- **Task tuning**
- **Continuous dimming**

### NLC systems can also provide high value non-energy benefits\*:

- Asset tracking
- Space utilization planning
- Simple adaptability for new tenants
- Integration with building systems, including HVAC and CO2 sensing systems
- Integration with building security and emergency response systems
- Demand response capabilities
- Energy code compliance

\* Not all systems have all of the capabilities listed

### Building types that can benefit from these additional capabilities include:

- Hospitals, utilizing asset tracking and space utilization
- Warehouses, for asset tracking and demand response
- Schools, for security and emergency response system integration and to enable lighting adjustments throughout the day for optimal learning environments
- Mixed-use office buildings, that take advantage of NLC's building systems integration, demand response, space utilization and lighting flexibility.



## What are some examples of NLC systems?

DesignLights Consortium (DLC) maintains a **Qualified Product List (QPL)** for Networked Lighting Controls. In order to be eligible for bonus incentives from Seattle City Light, systems must be listed on DLC's QPL. Below are some examples of qualified NLC systems.



*Enlightened luminaire level lighting controls installed in the Pacific Tower building in Seattle, WA.*

Acuity Controls nLight and NLight Air®	Enlightened
Acuity Controls Xpoint™ Wireless	LG Sensor Connect
Cree SmartCast™ Technology	Lutron Vive Wireless Solutions
Daintree Networks ControlScope®	Magnum Energy Solutions Magnum OPUS
Digital Lumens LightRules® and Siteworx Tune®	Philips SpaceWise and EasySense Advanced Grouping SNS200
Eaton WaveLinX Wireless Connected Lighting and LumaWatt Pro	RAB Lighting Lightcloud

## Questions?

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# CASE STUDIES

## PACIFIC TOWER

### Iconic building achieves flexibility and aggressive energy savings

#### The problem and opportunity

Seattle's Pacific Tower was an iconic building with a big facility maintenance challenge: its older systems were inefficient and falling short in meeting occupants' expectations. After the Washington Department of Commerce signed a 30-year lease to take over Pacific Tower, the team wanted to implement bold system upgrades and energy conservation measures to bring the building into the modern era and provide a better lighting experience for occupants.

#### The solution

The team hired McKinstry to research and install the best lighting option, with a special interest in integrating the building's HVAC system with occupancy sensing. McKinstry and the project team decided the Enlighted System featuring networked lighting controls (NLCs) was the ideal choice to enable this integration, reduce energy use and provide the flexibility to adjust to individual tenants' lighting needs.

"The Enlighted System is incredibly versatile," says Joe Moroni, McKinstry Building Systems Optimization Consultant and project engineer for Pacific Tower's NLC installation. "It is adjustable down to the individual fixture and gives feedback to the operators in real time, based on the energy use and temperature of the space and occupancy of the space. That sort of granular data is really helpful in achieving the types of aggressive energy savings that we're going after."

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"The top draw of the NLC system was definitely energy savings first. We knew we would see significant savings just switching to LEDs, but once we started setting light and thermostat levels, we were really able to cut off huge portions of energy costs just from the lighting."

**JOE MORONI**  
McKinstry

## Why networked lighting controls?

According to Moroni, an NLC system is an ideal solution for buildings like Pacific Tower with a variety of tenant types with different occupancy uses. From traditional office spaces to Seattle Central College's dental and nursing school laboratories, each tenant is able to get the right lighting for their individual needs. "The system can be recommissioned without actually changing out any of the hardware or infrastructure," commented Moroni.

In addition, tenants reap other benefits due to energy savings. "This is a state-of-the-art lighting system," says Stan Price, then-Executive Director for the Northwest Energy Efficiency Council, a building tenant since 2014. "We are probably getting the lowest-cost lighting services as we could expect from any office building. That, combined with a number of energy efficiency features, make Pacific Tower a great place for us to be a tenant."

## Recommendations when considering an NLC system

- Work with your utility. In this case, utilities can serve as a key partner to help vet the technology and provide incentives that help offset project costs.
- Take into account the cumulative cost effectiveness created by the technology and equipment you are considering. Installing LED fixtures with integrated sensors (luminaire level lighting controls) is a high return on investment measure that can significantly cut down the time it will take to achieve payback.

"This building is a model for the savings and benefits that can be achieved through integrated controls," Moroni said. "NLCs are a linchpin in our energy efficiency measures which enable occupant comfort in ways we haven't seen before. From color temperature



*The Enlighted lighting controls system was the ideal choice for building system integration and lighting flexibility.*

### BY THE NUMBERS:

- 2,000 LED fixtures were installed along with the Enlighted system
- Pacific Tower is seeing 80% energy savings compared to the previous system
- The building's lighting energy use is 27% better than Seattle's already progressive energy code

adjustments, which are really helpful in school settings, to thermostat settings that are optimal in office buildings like Pacific Tower, NLCs can be a key tool in ensuring your occupants are comfortable and productive."

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## **SOUTH LANDER BUSINESS PARK**

### **Installing networked lighting controls reduces costs and achieves long-term flexibility**

Seattle's South Lander Business Park boasts a variety of tenants from small retail spaces to large warehouses — all with differing lighting needs that may change over time. Starting in 2016, the owners knew they needed to upgrade their outdated fluorescent lighting to something more adaptable, flexible and cost-effective. The answer? LED fixtures with networked lighting controls (NLCs).

#### **The solution**

After first learning about NLCs, the executive team at South Lander decided to test out the technology in some of its smaller tenant spaces. With embedded sensors in each LED fixture, NLCs offer innovative controls strategies that provide maximum energy savings, easy installation and maintenance and flexibility in space utilization.

With the help of Seattle City Light and their energy efficiency incentives to offset the cost of NLC projects, South Lander installed the Cree SmartCast NLC system in several 2,000-3,000 sq. ft. tenant spaces and the Philips EasySense NLC system in a 30,000 sq. ft. space occupied by BNSF. These installations revealed both owner and tenant could reap benefits from energy savings to reduced maintenance costs — for essentially just the added cost of a sensor.

#### **ABOUT SOUTH LANDER BUSINESS PARK**

South Lander Business Park includes three buildings totaling 50,000 sq. ft. of space. Like many business parks, South Lander features tenant spaces in all shapes and sizes, with use cases ranging from small offices to integrated showroom and warehouse space. Spaces also change depending on tenants that move in and out.

#### **ABOUT NLCs**

All NLC systems offer the following controls strategies to maximize efficiency:

- Occupancy sensing
- Daylight harvesting
- Continuous dimming
- Scheduling for light levels
- High-end trim/task tuning to set the maximum level for power and light output
- Flexible zoning
- Controls persistence



“The maintenance savings are just as great as the energy savings. BNSF was able to track several years of invoices and found they were spending somewhere between \$5,000 and \$8,000 per year just on replacing fixtures and ballasts. Now, that’s almost zero.”

**JOE MITTER**

South Lander Business Park owner

## Increased flexibility

For the South Lander owners, installing an NLC system meant they didn’t have to worry about time intensive and costly wiring in the event a tenant’s lighting needs changed, or a tenant moved out.

“The main features we were looking for in this project were flexibility, tenant turnover and energy savings, and improved light quality was also an added bonus,” South Lander Business Park owner Joe Mitter said. “With just a phone app, I can now reconfigure the lighting in a space which gives us way more flexibility for switching things over when a tenant moves out.”

## South Lander’s largest tenant makes the switch

After successfully using NLC in several of its spaces, South Lander helped BNSF, its largest tenant, make the switch. According to Mitter, BNSF features nearly 30,000 sq. ft. of space across two buildings and has unique tenant needs: they regularly change over their spaces for different uses, and employees have varying lighting preferences throughout various offices and conferences rooms.

With NLCs, BNSF has addressed all of those challenges — including the ability to create lighting zones in their warehouse so they don’t have to turn on lights in all 5,000 sq. ft. at once. In terms of energy savings, BNSF and the business park’s other tenants have significantly cut their utility bills — for many, the system now pays for itself with energy costs lower than the monthly costs of the system. And, they’ve eliminated maintenance and ballast replacement costs. In just the first year alone, BNSF has saved \$7,500 on its utility bills.

“Energy and maintenances costs are the top two reasons, in addition to overall better quality of light,” South Lander Business Park owner Joe Mitter said. “In almost all cases, I would tell people to spend the extra amount for controls because they give you so much future flexibility. We’re future-proofing our lighting for the next 15-20 years.”

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# INDUSTRY-SPECIFIC APPLICATIONS

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## **NETWORKED LIGHTING CONTROLS FOR HOSPITALS**

Networked lighting controls (NLCs) combine LEDs, controls, connectivity and data for a flexible lighting system that can improve occupant comfort and space utilization in hospitals.

### The next generation of efficient lighting for hospitals

- Create a more healing environment with higher-quality lighting that adapts to patient needs
- Reduce unnecessary purchases and wasted labor by enabling smarter asset tracking for medical equipment, available in many NLC systems
- Increase patient satisfaction rates and staff happiness and productivity by optimizing light color and intensity

### Why choose NLCs?

#### **1) Easy installation and use**

Depending on the type of NLC system, products can include integrated sensors and controls for out-of-the-box set-up, while retrofit kits simplify installation for buildings with linear fluorescent fixtures. Many products allow remote programming and control through an app or tablet.

#### **2) Long-term flexibility**

Fixtures controlled by NLC systems are adaptable for changes in space usage, reduce the cost of change-over to new tenants. Simply re-group to the new lighting layout and adjust settings for new tenants.

#### **3) Energy cost savings**

NLCs use 25 to 75 percent less energy than non-controlled fixtures, reducing operating costs.

#### **4) Better occupant experience**

The right amount of light provides staff with a better work environment, increasing efficiency and happiness.

#### **5) Additional benefits**

Many systems are more comprehensive and enable valuable benefits such as asset tracking, space utilization, enhancements to safety systems and much more.

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## **NETWORKED LIGHTING CONTROLS FOR SCHOOLS**

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Networked lighting controls (NLCs) combine LEDs, controls, connectivity and data for a flexible lighting system that can improve occupant comfort and space utilization in schools.

### The next generation of efficient lighting for schools

- Enhance learning conditions with lighting that improves visibility and adapts to student needs
- Easily create the ideal lighting environment at any time of day, with energizing cool light in the morning and calming warm light later
- Increase safety, security and efficiency by enabling real-time tracking of building assets with many NLC systems

### Why choose NLCs?

#### **1) Easy installation and use**

Depending on the type of NLC system, products can include integrated sensors and controls for out-of-the-box set-up, while retrofit kits simplify installation for buildings with linear fluorescent fixtures. Many products allow remote programming and control through an app or tablet.

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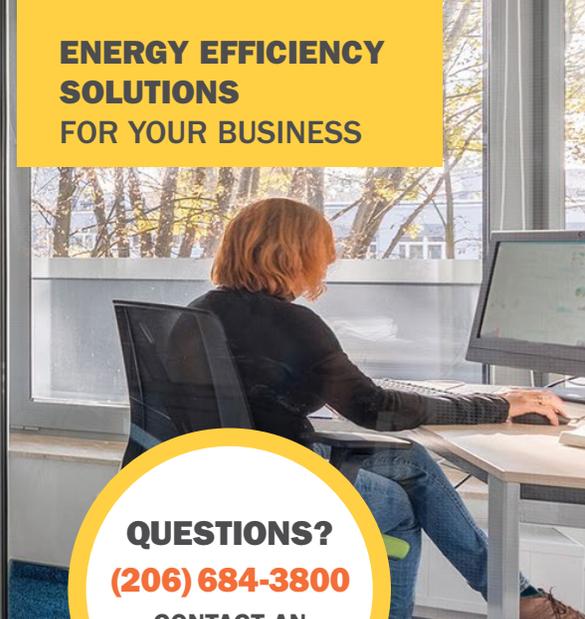
The right amount of light provides staff and students with a better work environment, increasing efficiency and happiness.

#### **5) Additional benefits**

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## **NETWORKED LIGHTING CONTROLS FOR OFFICE BUILDINGS**

Networked lighting controls (NLCs) combine LEDs, controls, connectivity and data for a flexible lighting system that can improve occupant comfort and space utilization in office buildings.

### The next generation of efficient lighting for office buildings

- Increase employee satisfaction rates and productivity by optimizing lighting for individual tenant needs.
- Tenant changeover is cost effective and easy with the ability to regroup lighting and adjust settings at the touch of a button — eliminating the need to rewire when new occupants move in.
- Increase safety, security and efficiency by discovering a building's most and least utilized spaces and enabling real-time tracking of building assets with many NLC systems.

### Why choose NLCs?

#### **1) Easy installation and use**

Depending on the type of NLC system, products can include integrated sensors and controls for out-of-the-box set-up, while retrofit kits simplify installation for buildings with linear fluorescent fixtures. Many products allow remote programming and control through an app or tablet.

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# EDUCATIONAL RESOURCES



## CONTROL TECH TERMS

This guide outlines key terms and concepts *you need to know* in order to communicate effectively with all project stakeholders.

### LET'S GET ON THE SAME PAGE

With the rapid pace of change in the lighting and controls industry, it is easy to confuse the ever-expanding list of new terms, technologies, and concepts being applied to networked lighting control solutions.

### Part #1: Understanding System Components

Most Networked Lighting Control (NLC) Systems have basic components in common. Understanding the discrete components will help you better understand the pros and cons of different systems available on the market.

COMPONENT	WHAT DOES IT DO	HOW DOES IT DO IT	NOTES
Luminaire driver	Controls power to the luminaire and regulates dimming	Various control protocols; 0-10 volt, DALI, DMX	Not all LED fixtures come standard with dimming
Load controller	Sends commands and data from luminaire to NLC system	Wireless radio signal to Gateway	Load may be luminaires, receptacles, or motors
Gateway or hub	Communicates wirelessly with NLC components and other building systems	RF, cellular, ethernet server	May be wired in very large systems or POE
Central server	A more robust computing platform for NLC's and other whole building systems	Programmed through system computer software	Not required for all NLC, but will be needed to interface with other BMS
Configuration tool	Allows users to program functionality wirelessly throughout the NLC system	Programs load controllers and all system devices	Can be an App, a computer application or a mix of proprietary hardware and software
Wall station	Allows users to send signals to the system and relevant luminaires	By manually pushing a button or touchscreen	Wall stations were formally just known as "switches" or "dimmers"

## Part #2: Basic Controls Terminology

Once you understand the system components, it's easier to understand basic controls concepts and terminology.

CATEGORY	PHRASE/CONCEPT	WHAT'S IT DOING
Sensors	Occupancy / Vacancy	Detects room or space occupancy
	Photo Sensing	Detects changes in light levels
Control Methods	High end Trim (task-tuning)	Reduces initial maximum light output to target levels
	Occupancy / Vacancy	Turns luminaires on when occupied, and down or off when nobody is present
	Daylight Harvesting	Reduces luminaire output when natural daylight is present
Controls Allocation	Zone	A collection of fixtures that are always controlled together the same way
	Group	A collection of control zones that are frequently controlled together, but not always
	Scene	A collection of control zones – with preset's – that can initiate a number of complex control strategies easily and repeatably

### SO IT'S ON MY NETWORK?

It is important to understand that though the system is a network, it does not necessarily need to be on the building IT network.

Many NLC systems operate on their own independent network.



### COMMUNICATION PROTOCOLS AND LOAD CONTROL PROTOCOLS

A **communication protocol** is a system of rules that allows two or more devices to transmit information.

*Common wireless examples include WiFi, bluetooth, Zigbee or cellular networks.*

A **load control protocol** can be thought of as the actual content in the message being communicated.

*Examples include DALI, DMX512, proprietary digital protocols or 0-10 volts (analog).*

## Part #3: Networked Lighting Controls and Luminaire Level Lighting Controls, What's the Difference?

Now that you understand the basic components and concepts, we can take a closer look at the two primary ways these lighting systems operate in commercial buildings.

### LLLC IS A TYPE OF NETWORKED LIGHTING CONTROLS SYSTEM

NLC and luminaire level lighting controls (LLLC) systems both deploy the same control strategies to ensure code compliance, tenant comfort, and sustained energy savings. Some products can be configured to operate in either mode.

The primary difference (and key concept) between these two approaches can be understood as a **1 to many vs. a 1 to 1 relationship**.

### NETWORKED LIGHTING CONTROLS

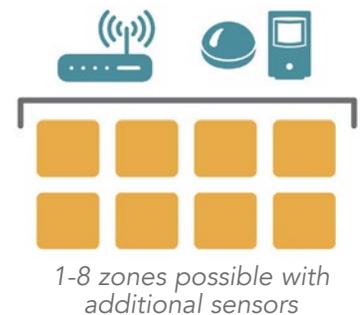
A networked lighting controls (NLC) system is the combination of sensors, network interfaces, wall stations, and controllers that affect lighting changes to luminaires.

In a NLC system configuration there is a **one to many** relationship with one sensor controlling many luminaires.

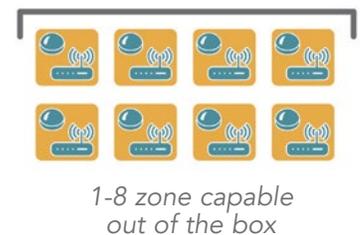
### LUMINAIRE LEVEL LIGHTING CONTROLS

Increasingly, manufacturers are integrating NLC system components directly into luminaires. With LLLC, there is a **one to one** relationship with every light fixture being capable of being controlled directly. Each luminaire is its own control zone or may be grouped into zones with multiple luminaires – simplifying design, installation, and space reconfiguration.

#### BASIC NLC CONFIGURATION



#### LLLC CONFIGURATION



## PRIMARY CONTROL STRATEGIES

This guide outlines three of the most important control strategies which should be considered for all lighting projects.

Now that LED light sources are the status quo, it is easier to control lighting than ever before. Control strategies which used to be time consuming and cumbersome can now be implemented effectively and inexpensively.



**1) High-End Trim**, also called task tuning, is the method of adjusting the maximum luminaire output at the time of installation in an effort to set the *target or recommended light level*.



**2) Occupancy Sensing** is how lighting systems respond when occupants enter or leave a space. Configuring a space for tenant comfort and code compliance means paying attention to Occupancy Mode and Vacancy Mode.

Fixtures can be grouped to minimize disruptions and occupancy settings are easily adjusted to account for sensitivity to movement and duration.



**3) Daylight Harvesting** is how lighting systems detect and adjust to natural daylight in a workspace. As photosensors detect enough natural light, they can automatically reduce the luminaires' light output.

### Fun Fact!

To compensate for light loss and other design factors – spaces are routinely specified to provide more light than may be initially needed. This is where control strategies can help.

### Know the Difference...

In **Occupancy Mode**, fixtures will automatically adjust light levels (or simply turn on or off) as occupancy is detected.

In **Vacancy Mode**, the user must physically turn the light source on. Lights then turn off automatically after a specified time when no occupancy is detected.

### Real Talk

Overlighting a space doesn't just waste energy – it may cause tenant discomfort and hurt productivity!

# NETWORKED LIGHTING CONTROLS



Consist of a combination of sensors, network interfaces, and controllers that affects not just light output, but how the lights operate throughout the day.

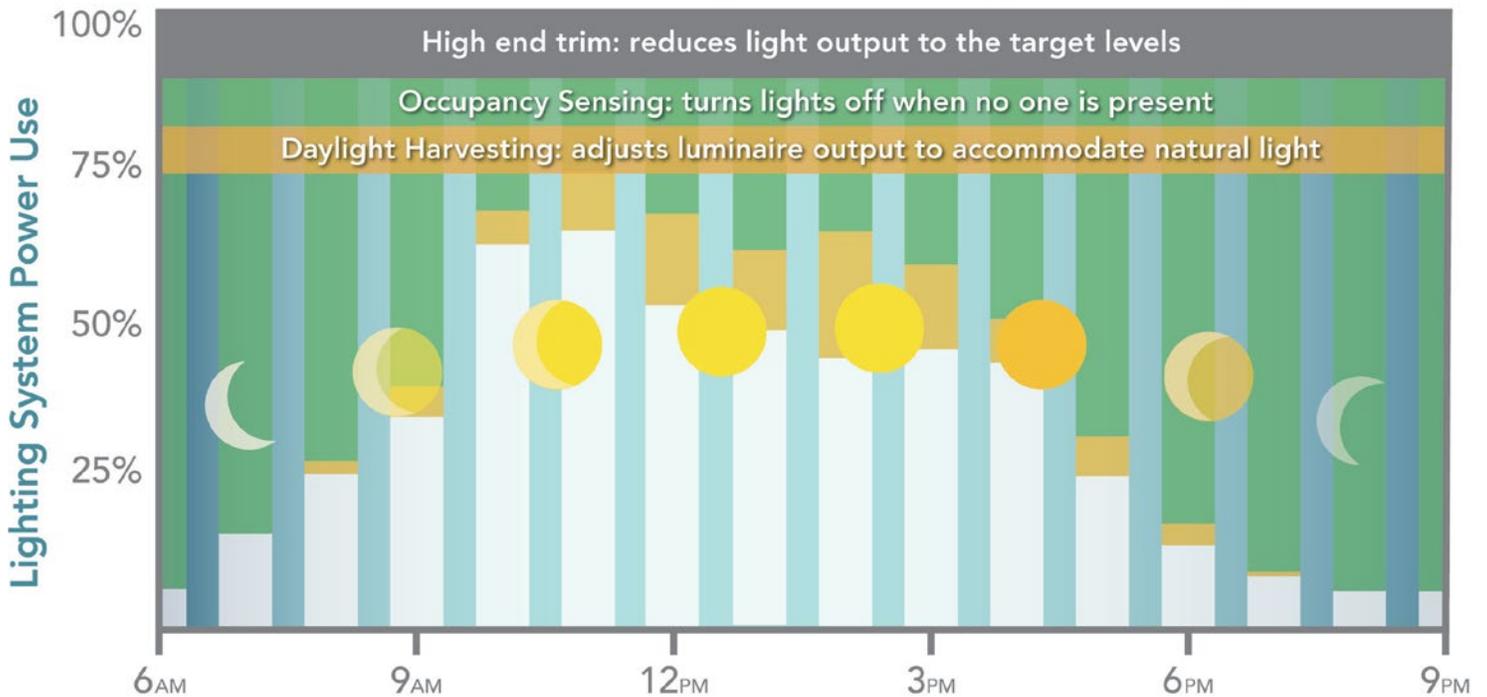


## Did You Know?

Many manufacturers offer fixtures with ambient light and occupancy sensors built into the fixture. When these fixtures are networked and dimmable, they are known as *luminaire level lighting controls*



## How these control strategies work throughout the day



## ALSO CONSIDER...

Other control strategies that can save energy and add benefits are:

- System scheduling** – can dim or turn lights off at certain times of day, such as after business hours
- Manual dimming** – allows users to adjust the lighting to their own personal preference

## SEQUENCE OF OPERATIONS

This guide outlines three different methods of documenting the SOO and describes the pros and cons of each approach.

*How you communicate the design intent of a networked lighting control system can make the difference between a great lighting project – and one you’d like to forget. Developing a sequence of operations (SOO) is the vital link between how a system is designed – and how it gets set up.*

### METHOD #1 - BASIC SOO MATRIX

SPACE TYPE	CONTROL METHOD				
	HIGH END TRIM	DAYLIGHT SENSOR	MANUAL SWITCH	OCCUPANCY SENSOR	TIME CLOCK
Conference	X	X	X	X	
Equipment	X	X		X	
Office - open	X	X		X	X
Office - private	X	X	X	X	
Restrooms	X			X	

#### Who's on First?

Responsibility for developing the Sequence of Operation can often be a gray area between contractors, product specifiers, and other relevant parties. Ensure this is discussed early in the process and the role is assigned.

#### Timing is Everything

For new construction, the sequence of operations should be completed before construction documents (bids) are finished.

For retrofit or tenant improvements, the sequence of operations should be developed with stakeholder input before installation begins.

The **basic SOO matrix** provides an at-a-glance view for each space type and control strategy. It is well suited for the start of projects – because it can effectively communicate basic control strategies and intent to owners and users. This allows stakeholders to provide meaningful input.

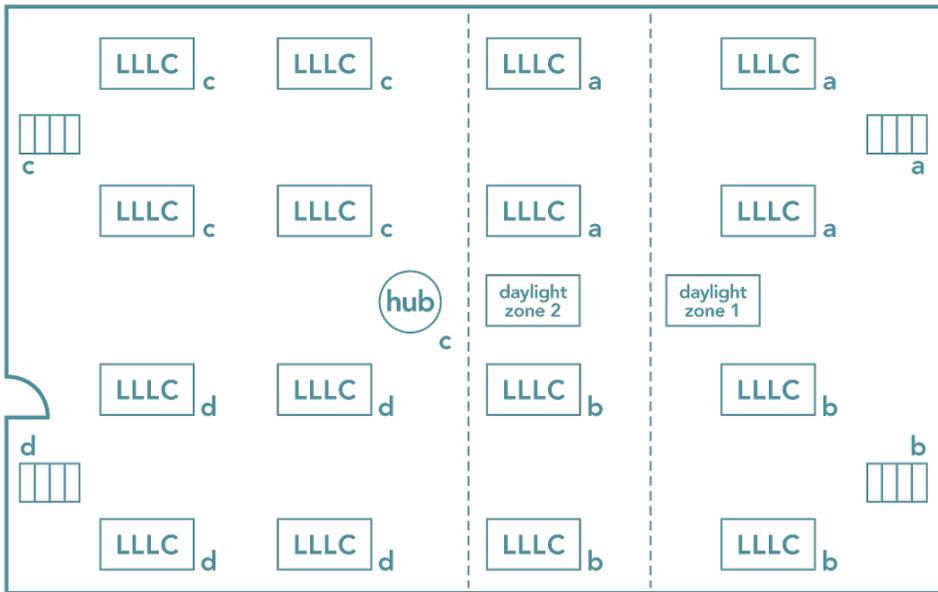
### METHOD #2 - DETAILED SOO MATRIX

Similar to the basic SOO matrix, the **detailed SOO matrix** will include detailed parameters for how each control method will be implemented within a space type. This usually takes longer to develop as various stakeholders may need to provide input.

Most networked lighting control projects will require a hybrid approach which includes elements of all three SOO methods outlined in this guide. What matters most is that design intent is being communicated to the stakeholders who will be programming the system – and eventually the people who will use it.

### METHOD #3 - NARRATIVE SOO MATRIX

The **narrative SOO matrix** may be seen on construction specs or directly on lighting or electrical plans. Typically, these call out the space types and include a short narrative describing desired operation. Narrative matrixes are extremely helpful for downstream stakeholder groups like tenants and facility staff. They may be accompanied by a basic or detailed matrix to provide context.



**SOO Matrix Example for an Open Office**

This open office design uses a LLLC system with integrated sensors and a connected gateway. The drawing has a legend to easily identify system components. A detailed matrix with narrative references the drawing to communicate complete design intent.

SEQUENCE OF OPERATIONS			
Area	Typical open office		
Lighting and controls	Lights	Zones (a) - (d)	Fully dimmable lights controlled in this area
	Daylight Zones	Zones (a) - (b)	Daylight rows 1 and 2 will dim independently. Lights will automatically adjust to daylight maintaining recommended 30FC on task surfaces
	Manual Wall Control	Zones (a), (b), (c), (d)	For each independent zone, the user can select scenes on/off, 50%, and can raise/lower the zone

**TIPS FOR SUCCESS**

At the beginning of a project, work with stakeholders to drive alignment and consistency with definitions and nomenclature to be used in the SOO.

- Define typical space types
- Define control strategies
- Define NLC system components
- Ensure the building owner or operator understands the SOO. This will save headaches down the road!

## WALL STATION INTERFACES

This guide outlines key considerations every lighting professional should review when selecting and programming wall station interfaces.

*For a typical end user, the most critical element of a lighting control system may be the wall station interface. These are usually the switches and dimmers with which end users interact. Wall station functionality will likely dictate the user's experience with the control system.*

### PRIOR PROPER PLANNING...

- Some upfront planning will pay dividends later in the project.
- Consistently labelling button stations, or their face plate bezels, will simplify system use for all occupants and prevent confusion.
- Work with user groups to determine appropriate labels.
- Many manufactures will print custom space – zone – or scene names on wall stations at a reasonable cost.



Switch stations are now available to perform many functions beyond the simple on/off we've come to expect from toggle switches. In most cases, specific button functionality is fully programmable and may be changed at any time. Some systems allow individual buttons to have different functionality.

### THE MOST COMMON PROGRAMMING OPTIONS INCLUDE:

Zone Toggle:	A selected lighting control zone may be turned on or off.
Group Toggle:	A selected group of lighting control zones may be turned on or off.
Scene Select:	A pre-programmed lighting scene is activated changing lighting to the most current scene.
Scene Toggle:	A pre-programmed scene is turned on or off. This may be in addition to other scenes or zones already active.
Raise / Lower:	Raises or lowers currently active lights zones, scenes, or groups proportionally.
Off:	Turns all zones to off by activating an OFF scene.

*Other options may be available depending on the specific system.*

## SUPPORTING THE OCCUPANT

Explaining what a user can expect from a lighting control system, and how to interact with it, can be the difference between happy users and frustrating call backs. Consider creating graphical cards or explanations that may be posted or provided to new users.



**Put yourself in the shoes of a typical user and ask the following questions...**

- Is the interface simple to operate and immediately understandable?
- Is it unclear and potentially frustrating?
- Does it require a user manual to operate the lights?
- Is there a YouTube channel or easy online resource you could connect the user group with for future reference?

## WIRED OR BATTERY?

Wall stations generally communicate wirelessly with control systems via RF signal. Most manufacturers are trending toward battery-operated wall stations, frequently featuring 10 year or more average battery life.

This significantly reduces material and labor costs, particularly in retrofit applications. Wall stations using 120 V power are still available when battery stations are not preferred.

WALL STATION INSTALLATION Cost / wall station	
Wired Solution	Wireless Solution
~\$150-225 labor & materials	~\$30-50 labor & materials
What's Included	
Wired wall station	Wireless wall station
Conduit and wire	No pipe or wire
Drywall and paint	No wall repair
1-2 hours labor	15-30 minutes labor



## COMMUNICATING THE VALUE PROPOSITION

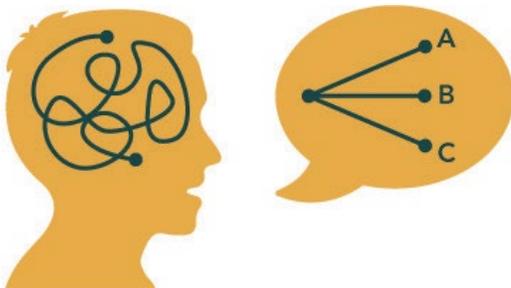
This guide will help simplify and clarify your value proposition by outlining distinct stakeholder groups and detailing what matters to them.

### KNOW YOUR AUDIENCE – PLAN YOUR APPROACH

Networked lighting control systems offer plenty of benefits – but potential customers can feel overwhelmed or turn skeptical when they perceive too many promised benefits. Effectively communicating the value of NLC systems starts with knowing your audience – and planning your approach.

#### STEP 1: IDENTIFY YOUR STAKEHOLDERS

Yes, working with the key decision maker is paramount to making a project come together – but the key decision maker represents a cohort of stakeholders whose opinions matter.



#### STEP 2: SIMPLIFY YOUR MESSAGE

Instead of trying to convey *all* the potential system benefits to a general audience – examine the critical needs for each stakeholder group and use concise language to address their needs.



**TENANTS**

What does the user care about? What do we need to avoid?



**BUILDING OPERATORS**

What matters most to the building operators?



**CONTRACTORS AND INSTALLERS**

Where are the current contractor pain points?



**BUILDING OWNERS**

Which non-energy benefits matter most to this decision maker?

Once you have identified your relevant stakeholders and simplified your message, you can begin crafting a proposal which targets the key decision maker while effectively incorporating value propositions that matter most to relevant stakeholders.

## STEP 3: RIGHT POSTAGE, RIGHT ADDRESS

To help keep your message clear – organize your proposal into one section that covers financial elements and another that identifies qualitative system features and connects them to key stakeholders needs.



Using your industry experience, build off the common examples listed below – to help your next proposal stand out from all the rest.



### TENANTS

*Living with the system*

- Easier way to interface with the building
- Increase in comfort and productivity
- Increased lighting quality and space appearance
- More personal and flexible way to control lighting



### BUILDING OPERATORS

*Leveraging the system*

- Easier way to interface with the building
- Reduced maintenance time and cost
- Monitor, dashboard, and control system as needed
- Extended luminaire and system life
- Integration to other building systems



### CONTRACTORS/ INSTALLERS

*Implementing the system*

- Simplified installation and maintenance
- Allows for more flexible designs
- Create longstanding relationship through consistent optimization
- Platform for additional value-adding services



### OWNERS

*Investing in the system*

- Flexibility for future space changes
- Meet code or certification requirements
- Reduced operating costs
- Future proofing the building with tomorrow's NLC features

## EMERGING TECHNOLOGY TRENDS

This guide outlines emerging technology trends you should be aware of, so you are well positioned to meet new demands from customers.

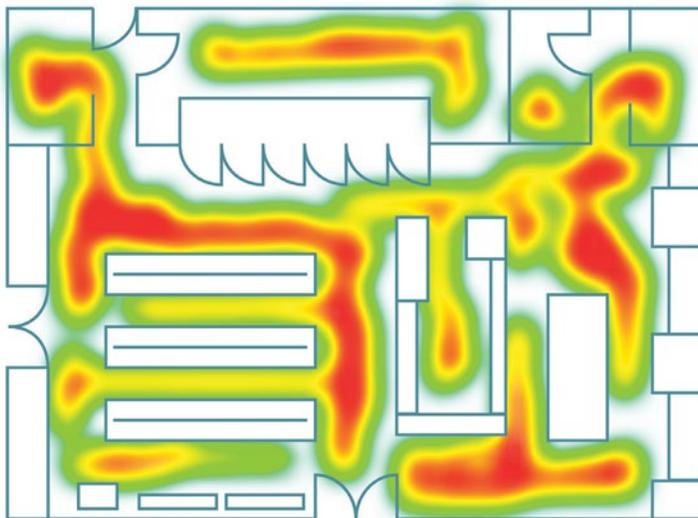
*The lighting and controls industry is moving rapidly towards a future where connected lighting is the communication and infrastructure backbone for the Internet of Things (IoT). Networked lighting controls will play a key role as we enter the era of smart buildings, connected communities, and smart cities.*

### LIGHTING WILL BE THE BACKBONE OF THE IOT

Lighting is in our homes, in our businesses, and on our streets. Lighting is ubiquitous throughout the world we have built – and it is energized. This simple fact is why many consider lighting to be the backbone of the IoT market transformation.

*Market shift to IoT is occurring as an increasing number of products employ integrated sensors such as LLLC*

The types of sensors now being integrated into luminaires depends on the application. Office lights are equipped with sensors that can talk to HVAC. In retail applications, infrared and Bluetooth detecting sensors embedded in the lights track customer shopping patterns.



Typical retail hot-map analytics enabled by Lighting Controls IoT Ecosystem

### Light & Health



There has been a recent resurgence in the focus on lighting quality, and the physiological effects of light on humans in our homes, businesses, and outdoors.

Ongoing research suggests that lighting – both daylight and electric – play central roles in our endocrine and circadian systems and overall health.

Lighting controls may help to modulate the variables currently being researched, including lighting intensity, duration, timing, and spectral power distribution.

## BILLIONS AND BILLIONS...

There really is no limit in sight to the number or types of sensors that could be embedded into future luminaires. Our lights are capable of doing so much more than just lighting and creating new customer benefits.

### What's in Tomorrow's Streetlight?

Smart St.

Parking Management

Public Wireless Networks

Air Pollution Sensors

Seismic Sensors

Concealed Speaker

Gunshot Detection

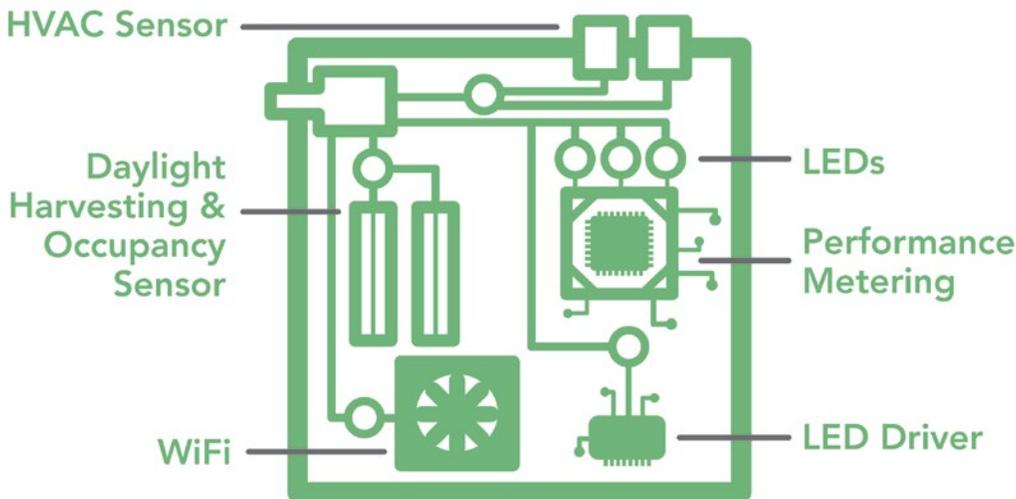
Digital Signage

Wire Theft Detection

And more...

## WHAT'S NEXT: CONTINUED SYSTEM INTEGRATION

As demand for additional services in lighting grows it is becoming more cost-effective for manufacturers to include sensors as a standard offering. Think how hard it would be to buy a cell phone without a camera, or GPS, or accelerometer?



### Performance Metering

As networked lighting controls integrate with building management systems, real-time energy monitoring is also becoming a reality.

## TUNABLE WHITE & COLOR TUNING

Luminaires equipped with warm and cool LEDs, or multi-color LED packages may be capable of field selection or correlated color temperature selection.

As the integration trend continues color and white tunable systems will become standard equipment offerings in the future. This will become another key non-energy benefit of smart lighting control.