



Introduction to the DLC's new Toolkit for Lighting-HVAC Integration

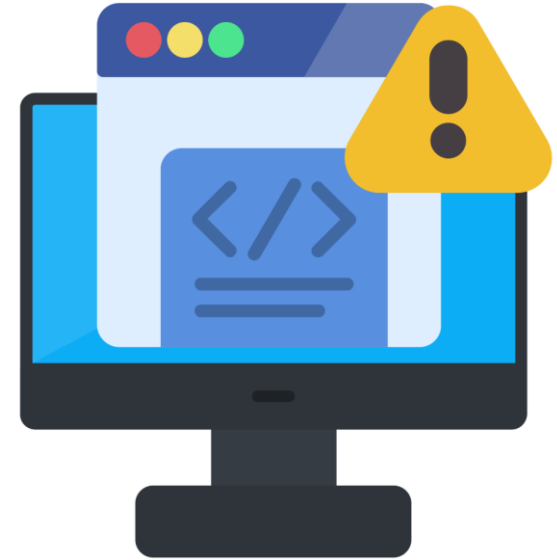
Tuesday April 2, 2025

GoToWebinar Logistics

Questions Pane about contents



Chat Pane for technical difficulties



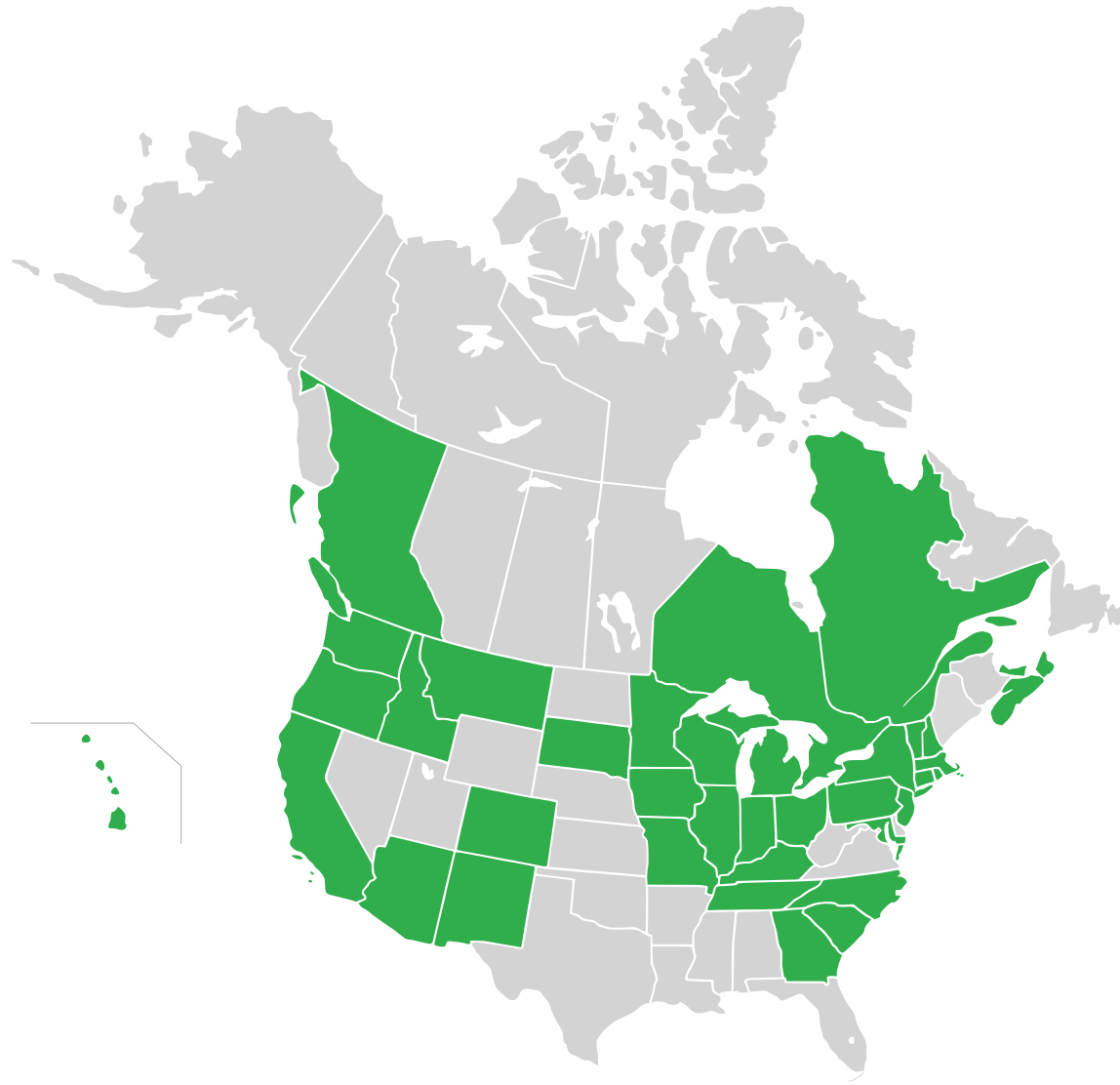
Recording will be available

The screenshot shows a web browser at the URL designlights.org/news-events/on-demand-past-events/. The navigation bar includes the DLC logo and menu items: FIND PRODUCTS, ABOUT US, OUR WORK, RESOURCES (circled in red), NEWS & EVENTS, and JOIN US. A search icon and a MyDLC button are also present. Below the navigation bar, the 'The DLC Resource Hub' section is visible, featuring a description of commercial lighting resources and a 'BROWSE RESOURCES' link. To the right, a 'Watch' section lists 'On-Demand Webinars' (circled in red), 'Video Tutorials', 'Trainings', and 'Upcoming Events'. The 'Read' section lists 'Reports and Research', 'Technical Resources', 'How-to Guides', 'DLC Blog', 'Glossary', and 'NLC Case Studies'. At the bottom, there are three promotional banners for 'New Technical', 'Memorandum', and the DLC logo.

What is the DLC?

- Non-profit
- Lists of high-quality energy-efficient lighting products





The DLC is supported by 65 Member programs throughout the U.S. and Canada.

Recorded Presenters



Levin Nock
DesignLights
Consortium



Ron Berstein
RBCG Consulting



Matthew Turk
Newcomb & Boyd

Agenda

1. Introduction
2. Explore the Toolkit
3. The Toolkit's Value for Integration Projects
4. Standardized Digital Protocols for NLC
5. Conclusion
6. Questions and Answers

A photograph of a person's hands reaching up towards a glowing, rectangular light fixture in a modern office environment. The light fixture is mounted on a ceiling with a grid pattern. The hands are positioned on either side of the light, with fingers slightly curled as if about to touch it. The background is a bright, slightly blurred office space with large windows and structural beams.

Affordable, reliable energy savings

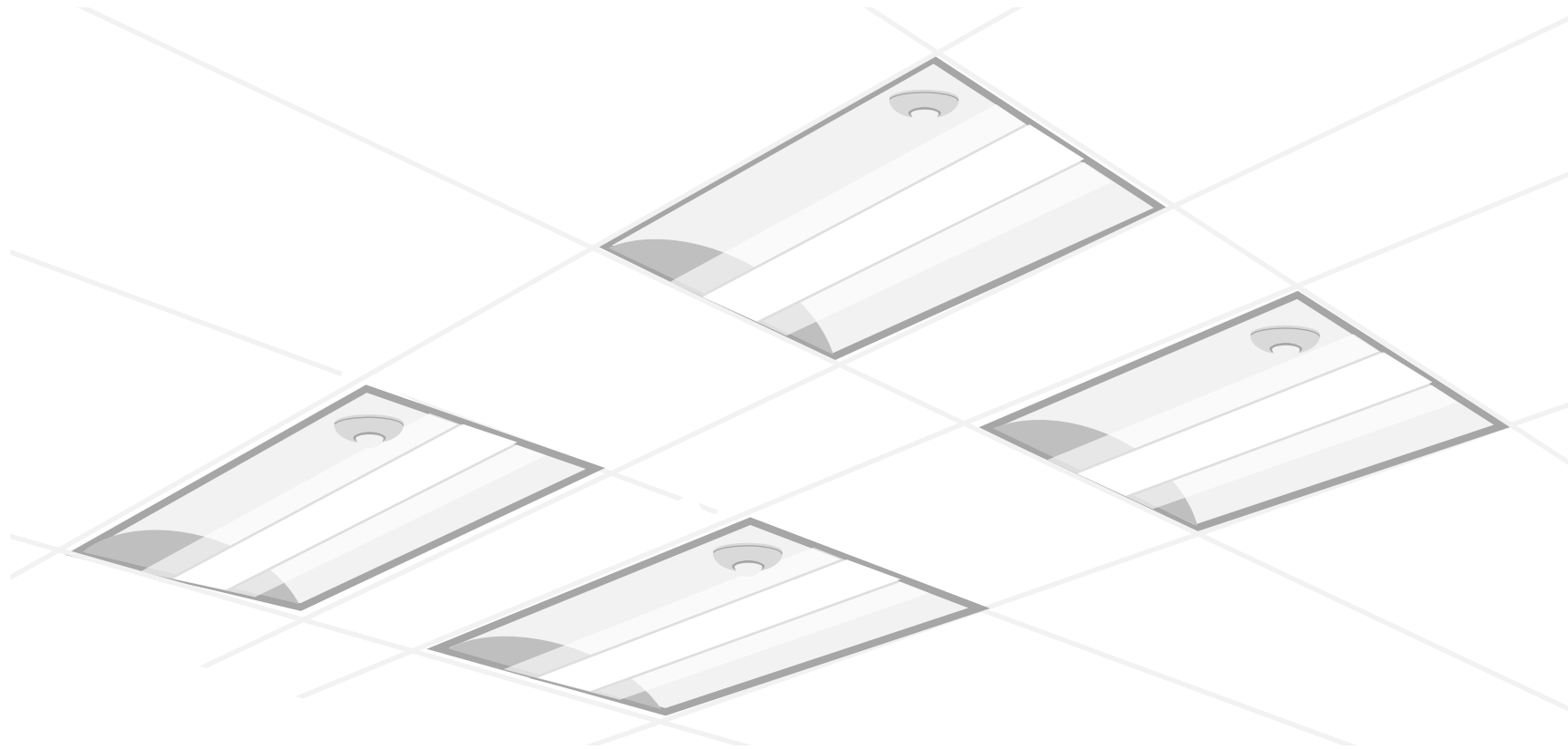


Efficient LED baseline

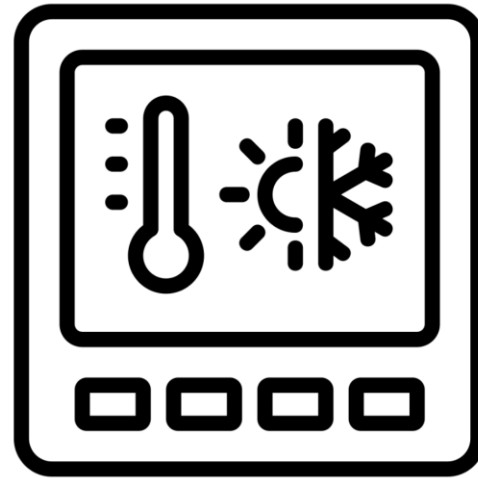


Slow NLC uptake

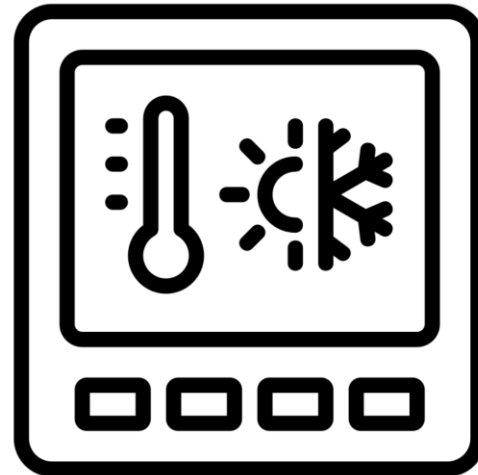
Powered, Networked, Ubiquitous Occupancy Sensors



NLC Occupancy Sensors can inform HVAC controls

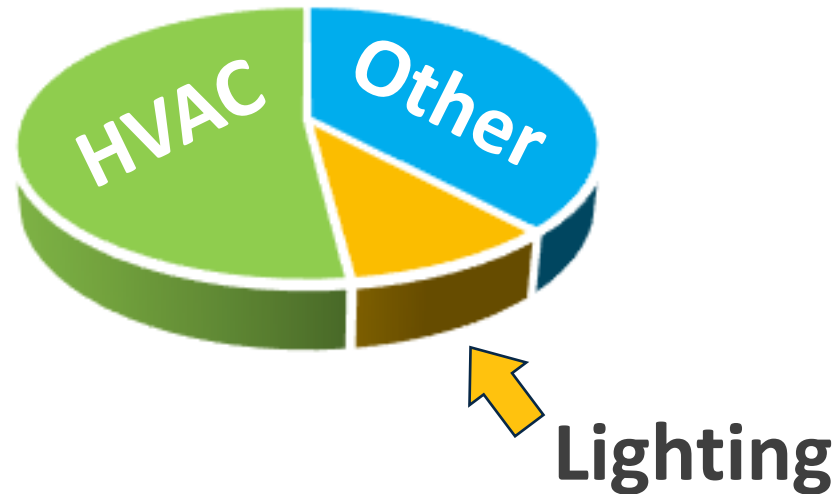


NLC Occupancy Sensors
can inform HVAC controls for
Occupied Standby Mode.



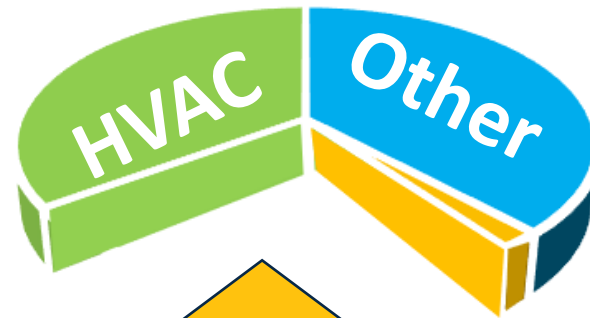
Energy use in commercial buildings in 2018

Lighting	10%
HVAC	52%
Other	38%



CBECS (Commercial Buildings Energy Consumption Survey), US EIA, 2022

In suitable buildings, lighting retrofits with NLC-HVAC integration save over 20% of the whole building energy load.



Deep Savings

Rebates

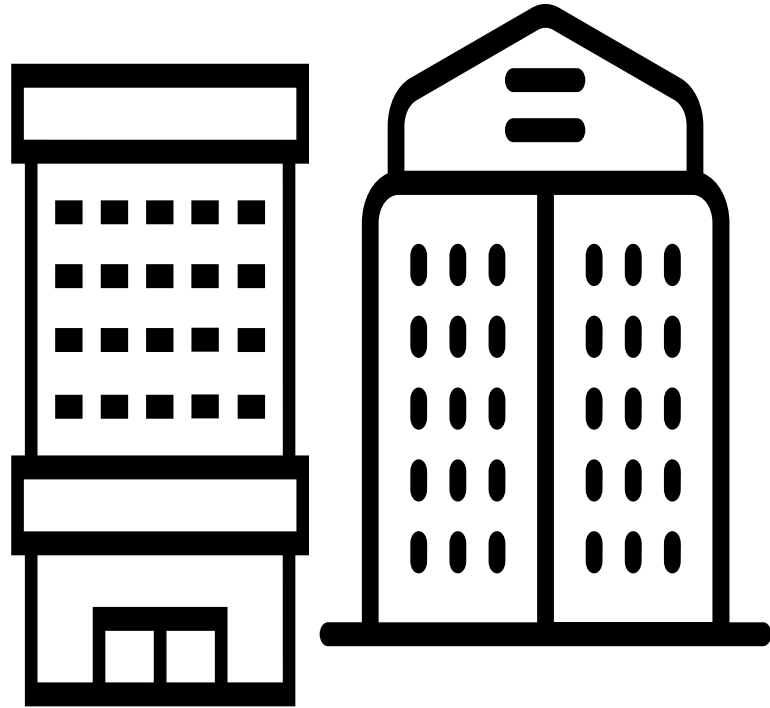
Incentives

Lower Energy Bills



Large Buildings

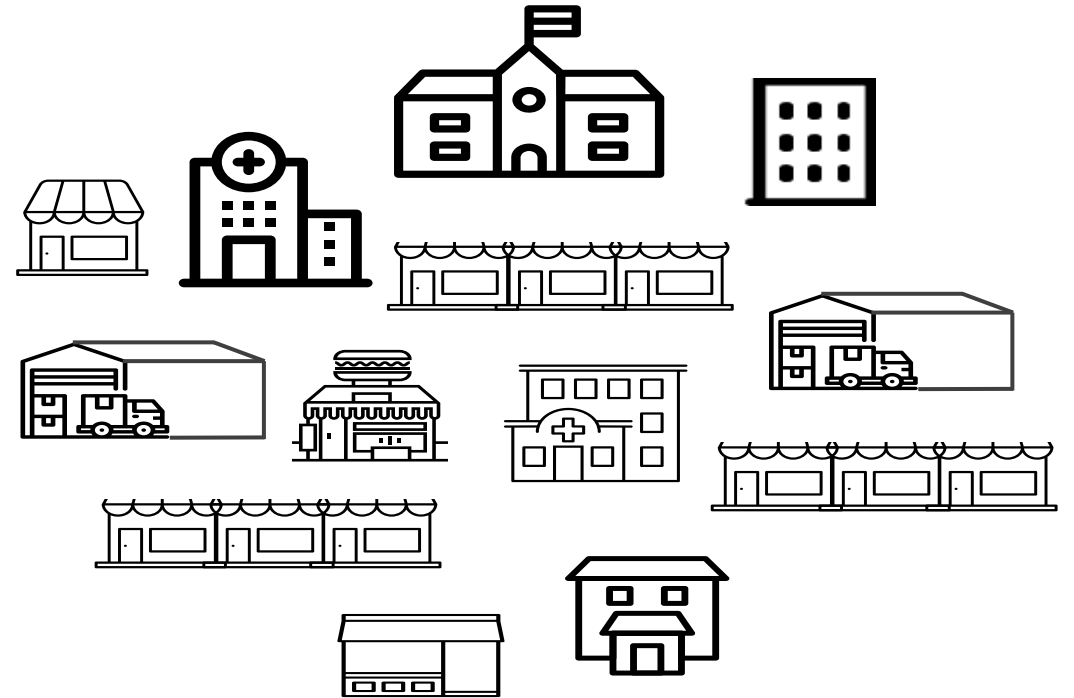
Digital Now



50% of commercial square footage,
6% of buildings

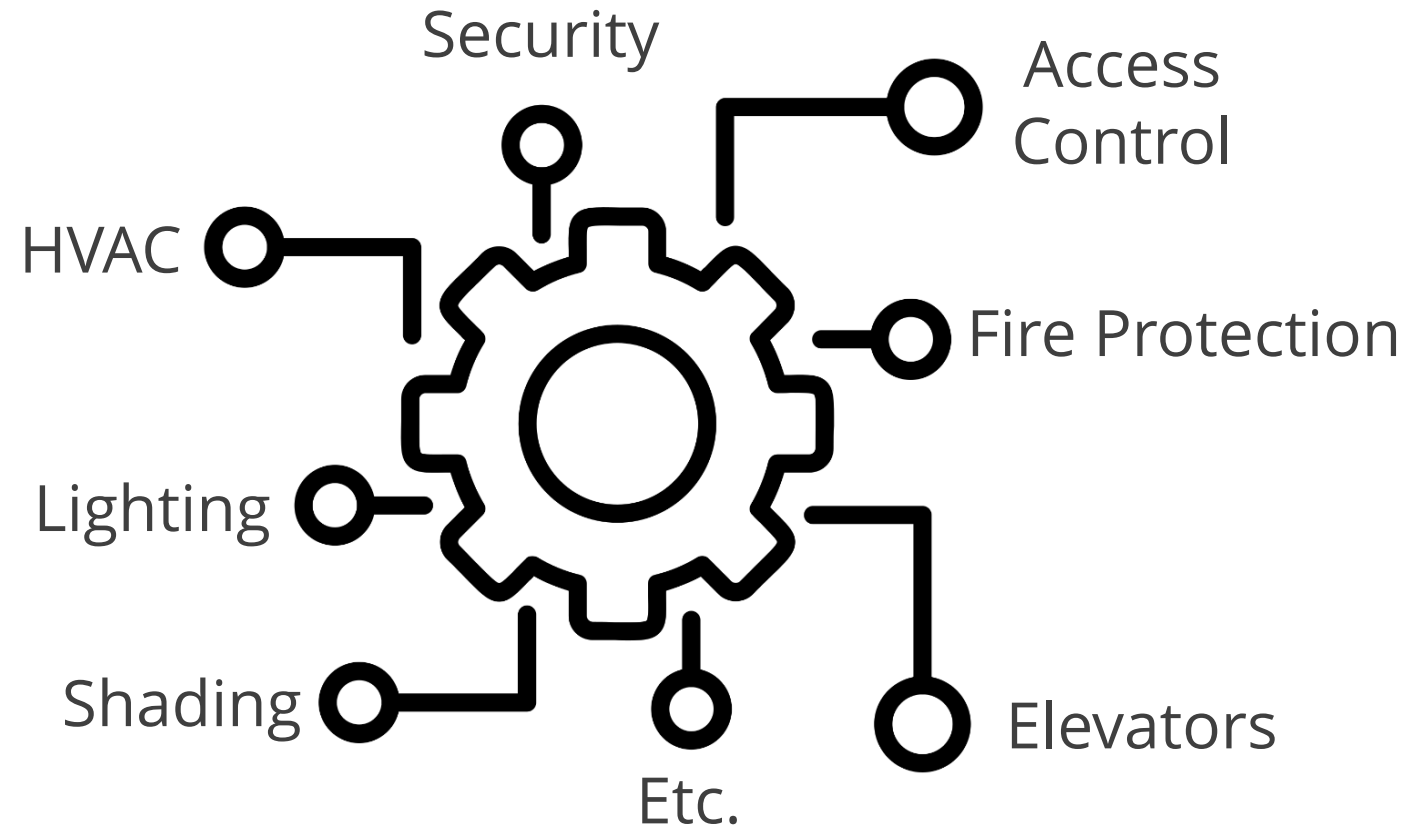
Smaller Buildings

Analog Now, Digital Soon



50% of commercial square footage,
94% of buildings

Building Automation



NLC-HVAC integration



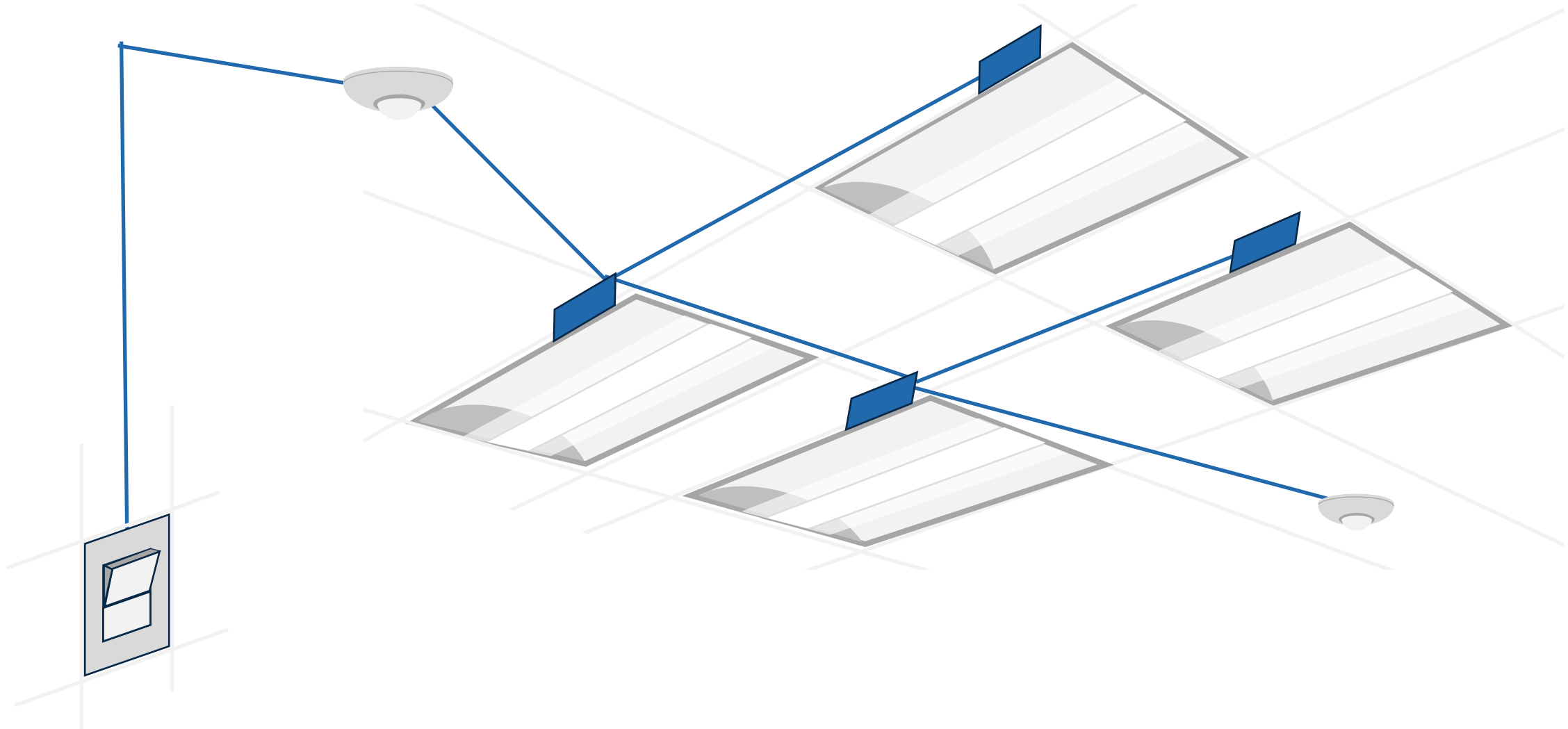
betterbricks.com



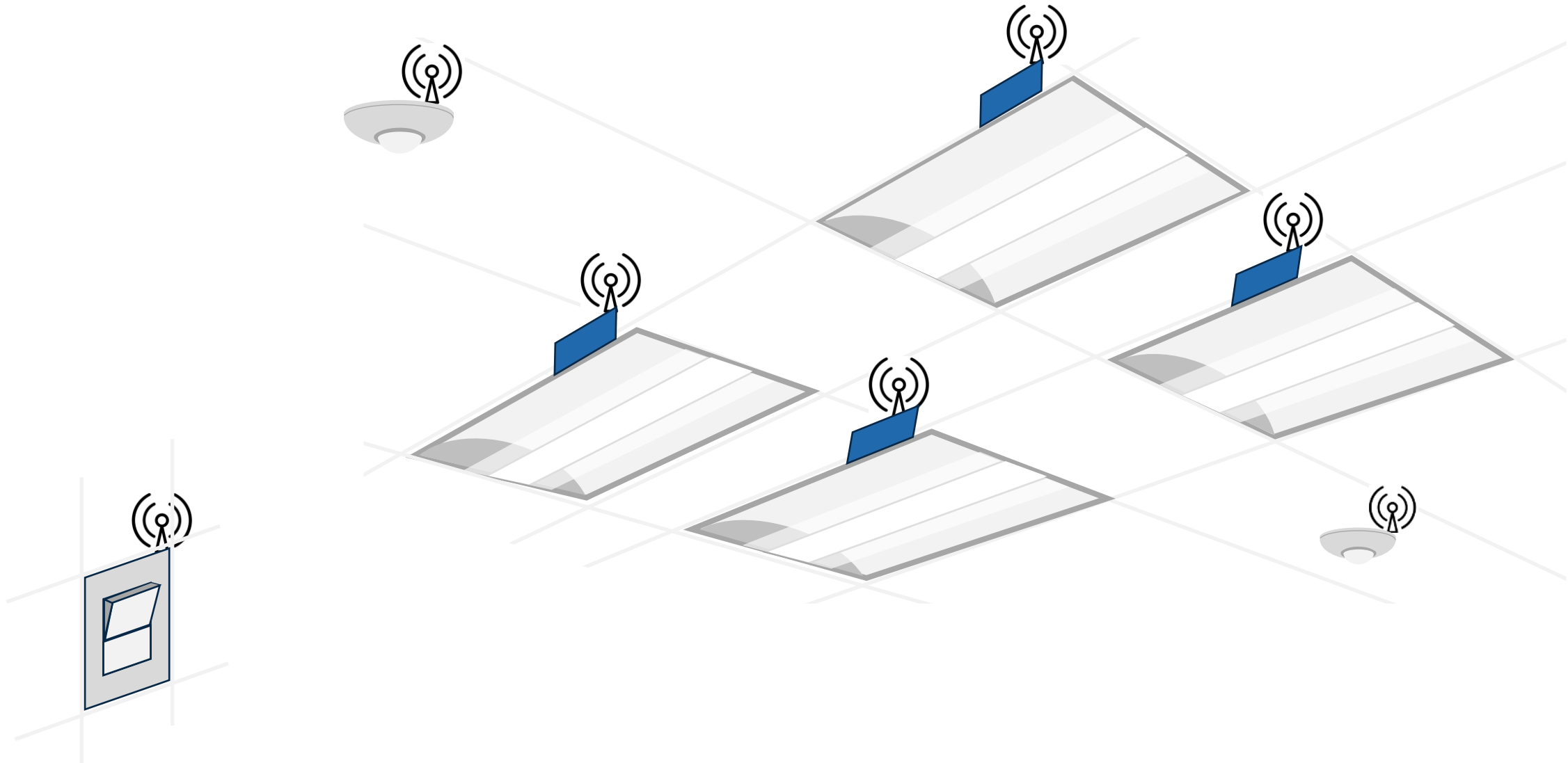
Definitions



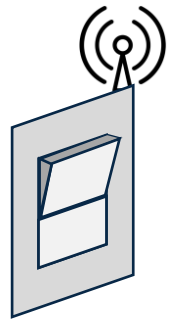
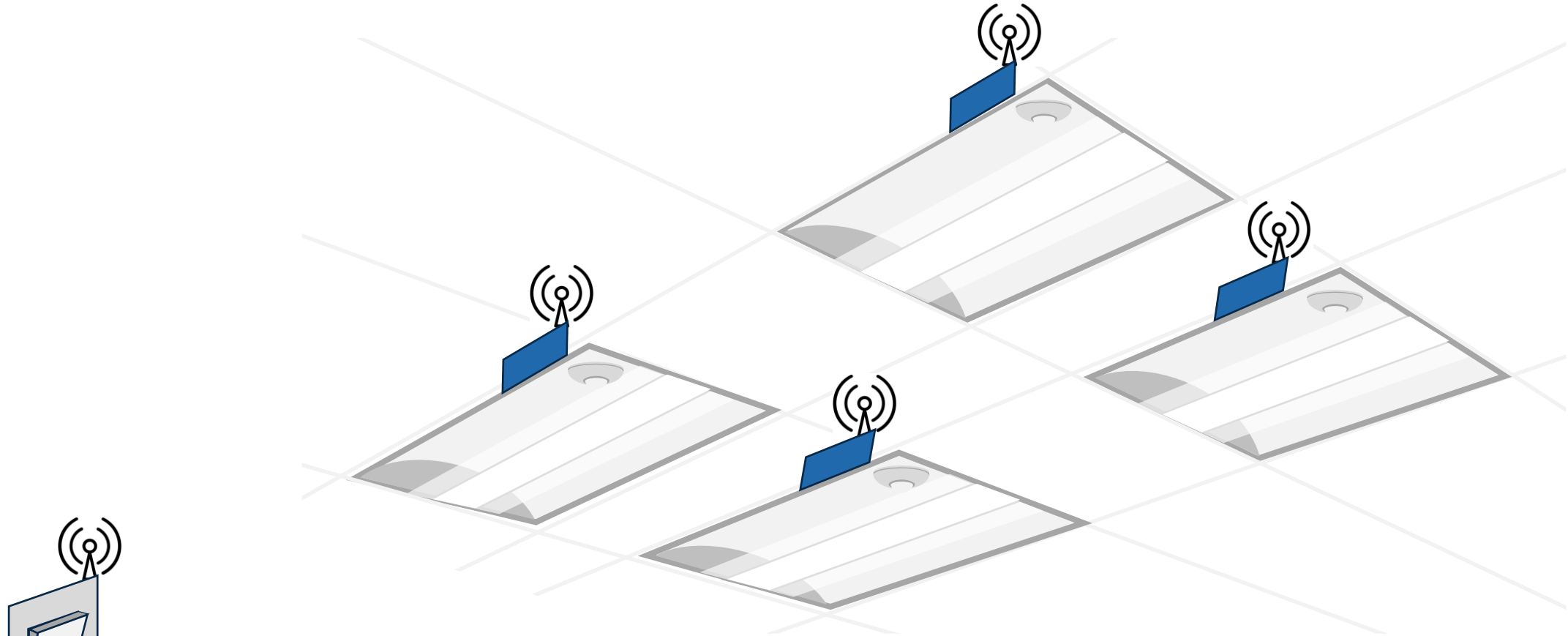
Define “Networked Lighting Control” (NLC)



Define “Networked Lighting Control” (NLC)

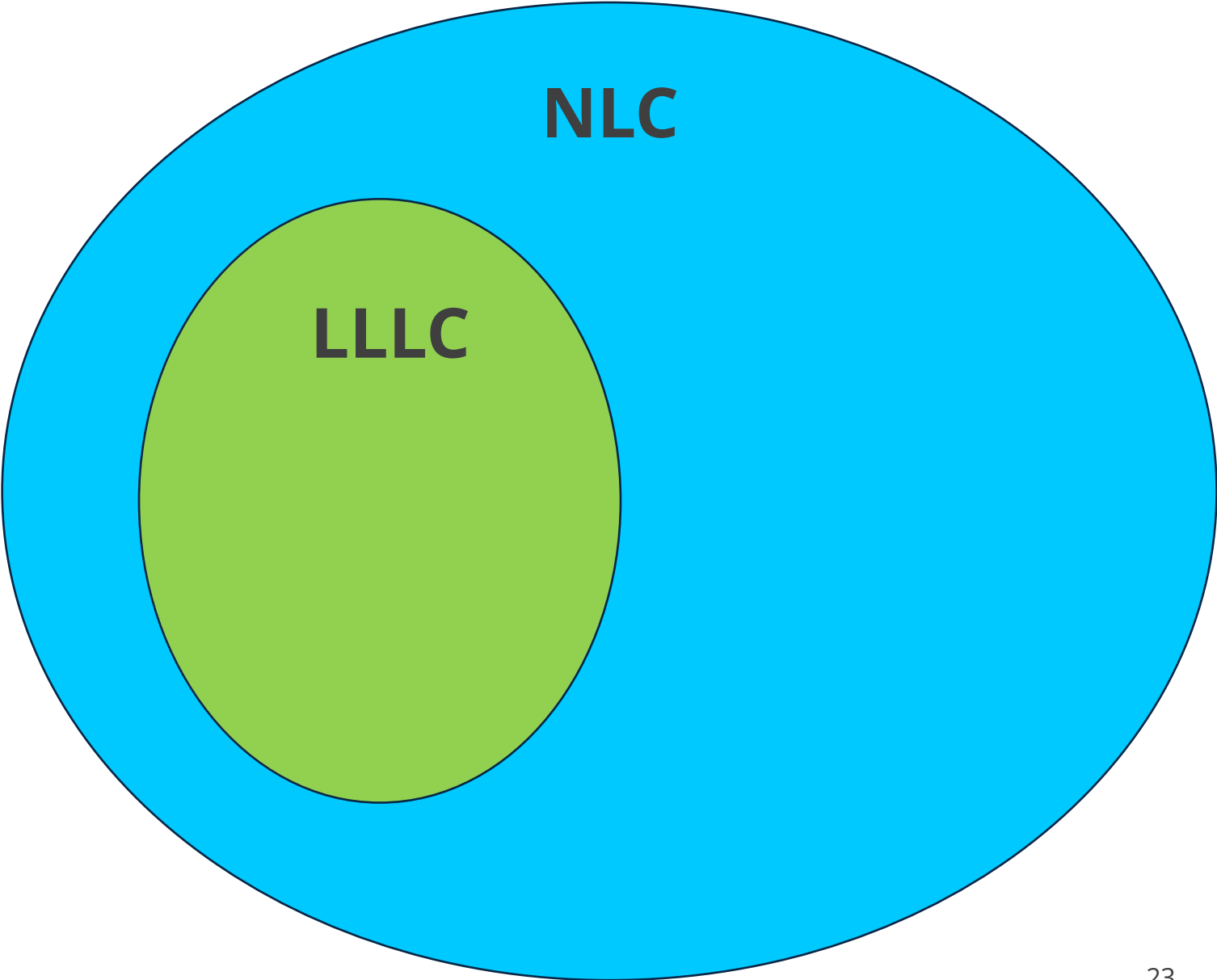
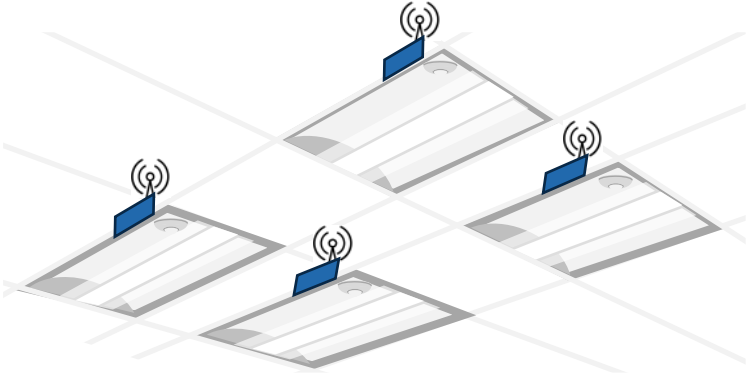


Define “Networked Lighting Control” (NLC)

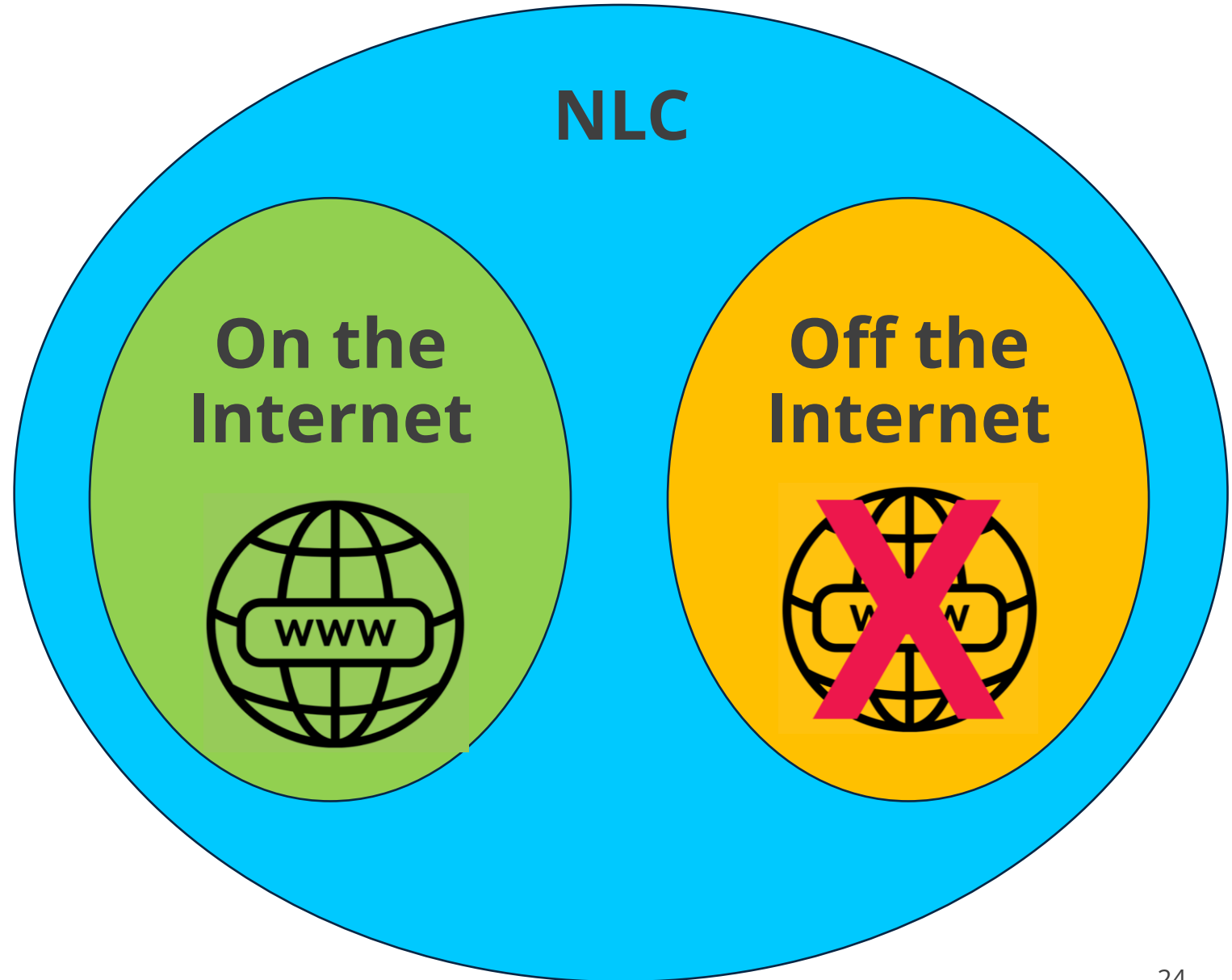


**LLLC = sensors on every luminaire
(Luminaire Level Lighting Control)**

LLLC is a kind of NLC



NLC can be on the Internet or not



Some NLCs access the Internet occasionally through a phone



Agenda

1. Introduction
- 2. Explore the Toolkit**
3. The Toolkit's Value for Integration Projects
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TOOLKIT

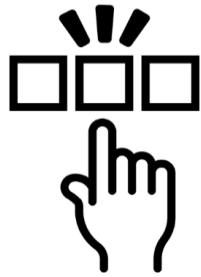


FIND PRODUCTS ▾ ABOUT US ▾ OUR WORK ▾ RESOURCES ▾ NEWS & EVENTS ▾ JOIN US ▾



Toolkit Goals

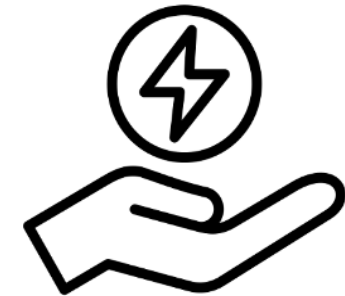
These tools will help you



Choose appropriate projects



Collaborate better



Save energy

Presentation Goals


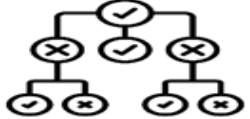
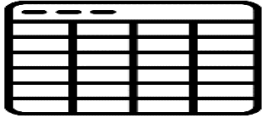



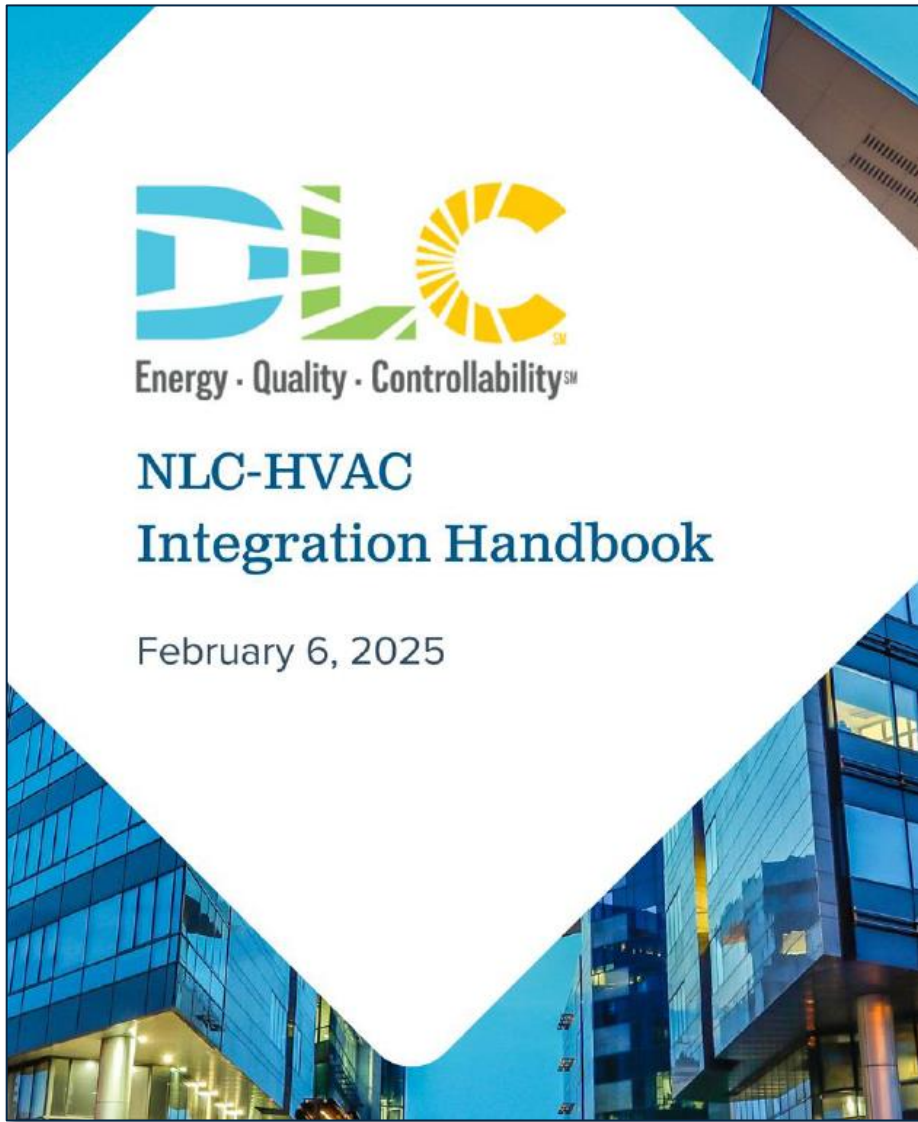
Toolkit Introduction



Suggest changes:
info@designlights.org

Toolkit Files

1	Handbook	PDF	
2	Decision Tree	PDF	
3	Case Studies	Excel	
4	Responsibility Matrix	Editable Excel	WHAT? ?WHO!
5	Project Template	Editable Word	

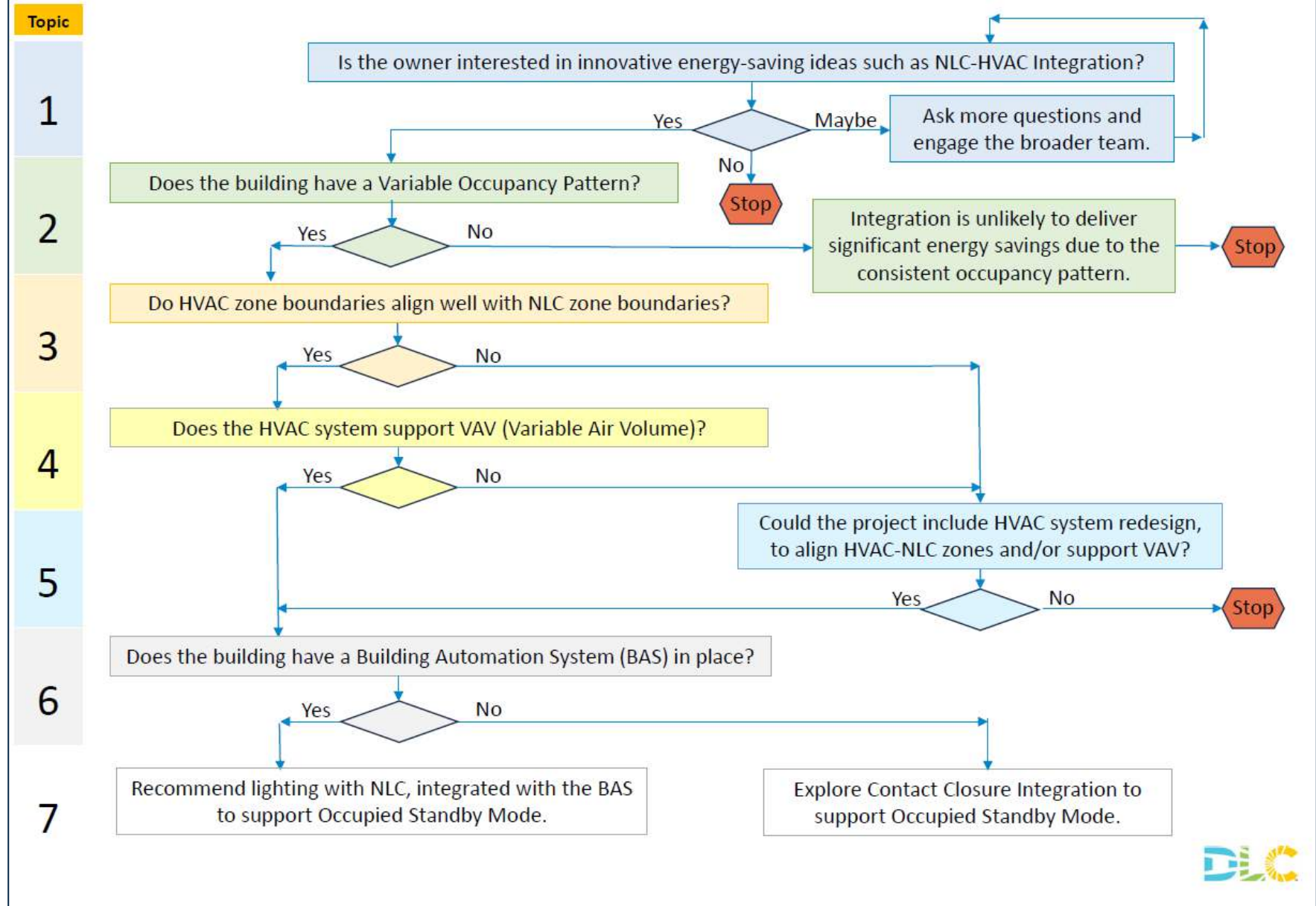


Handbook Contents

Contents.....	2
Executive Summary.....	3
Background	4
Benefits of NLC-HVAC Integration	5
Definitions and Terminology.....	5
Introduction to NLC.....	10
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Introduction to BAS/BMS.....	15
Best Practices for Successful Integration	17
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Decision Tree Diagram

NLC-HVAC Integration Decision Tree Diagram



A Detail Page for Each Topic

Topic 1: Is the Owner interested in innovative energy-saving ideas such as NLC-HVAC Integration?

- Issues to Explore:**
 - The owner may not know about it. Advise. Engage with broader team.
- Clarifying Questions:**
 - Is there economic value?
 - Is there energy efficiency value?
 - Are equity-based incentives available?
 - Is the building subject to new regulations that value and might even incentivize?
 - Is there integration value?
 - Are there code or standard requirements?
 - Is there corporate standard requirements?
 - How long will this building be occupied? Unless the building is being demolished, stop, unless the building is being demolished.

Topic 2: Does the building have a Variable Occupancy Pattern?

- Issues to Explore:**
 - The building owner may not know. Advise. Engage with broader team.
- Clarifying Questions:**
 - How predictable is the occupancy from day to day? If not, are some days more predictable than others?
 - If the occupancy pattern is predictable, is it lower cost than occupancy-based control?
 - To rely on scheduling instead of occupancy-based control, is it more cost-effective?
 - If the building has a Variable Occupancy Pattern, are there other words, are one or more HVAC zones that can be controlled to maximize the HVAC energy savings from occupancy-based control?

Topic 3: Do HVAC Zone boundaries align well with NLC Zone boundaries?

- Issues to Explore:**
 - Lighting zones are often smaller than each HVAC zone (making integration more difficult)?
 - This is typically a question handled by the electrical/lighting engineer.
- Clarifying Questions:**
 - If the lighting and HVAC zones do not overlap issues? If yes, proceed. Call the electrical/lighting engineer.
 - Does the HVAC system have its own control system?
 - If you're wondering how well the lighting and HVAC systems are integrated, see the [DLC NLC-HVAC Controls Integration Toolkit: Handbook](#).

Topic 4: Does the HVAC system support VAV (Variable Air Volume)?

- Issues to explore:**
 - This question matters to everyone, but integration project will probably not be successful.
- Background:**
 - Variable Air Volume describes a type of system depending on how much ventilation is needed according to the control signal for Occupied Standby Mode well, but increase it when a space is occupied.
 - An alternative to a VAV system is a constant volume system. CAV systems are not as energy efficient, but not much more expensive with upgrades from CAV to VAV.
- Clarifying Questions:**
 - What is the projected end-of-life of the HVAC system? Is it worth the cost of replacement?
 - What energy efficiency rebates are available?
 - What penalty fees, building market conditions, etc. are there?

Topic 5: Could the project include HVAC system redesign, to align HVAC-NLC zones and/or support VAV?

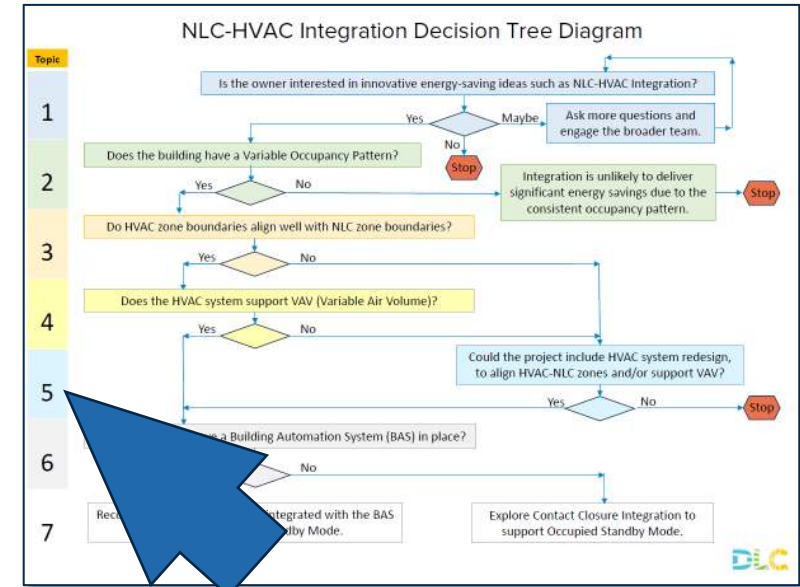
- Issues to Explore:**
 - For a new HVAC design and new HVAC system, but the new HVAC system is not yet designed.
 - Multiple case studies of successful HVAC components to support VAV.
 - New HVAC systems such as mini-split systems.
 - When a new HVAC system and new naming conventions and zoning boundaries are required.
- Clarifying Questions:**
 - What is the projected end-of-life of the HVAC system? Is it worth the cost of replacement?
 - What energy efficiency rebates are available?
 - What penalty fees, building market conditions, etc. are there?

Topic 6: Does the building have a Building Automation System (BAS) in place, or already planned?

- Issues to Explore:**
 - For retrofit construction, ask the owner if they have a BAS.
 - For new construction, ask the MEP engineer if they have a BAS.
- Clarifying Questions:**
 - Does the building already have a BAS, but the new BAS can potentially be integrated with the existing BAS?
 - Can the HVAC system be programmed from the NLC system?
 - Does the lighting vendor support integration with the BAS?

Topic 7: Recommend integration to support Occupied Standby Mode, using BAS or Contact Closure.

- Issues to Explore:**
 - To proceed with NLC-HVAC integration, see the "DLC NLC-HVAC Controls Integration Toolkit: Handbook" for Best Practices.
 - See also the "DLC NLC-HVAC Controls Integration Toolkit: Case Studies" for Lessons Learned, especially from integration projects that share their building type and/or other characteristics with your own project.
 - When NLC-HVAC integration occurs in buildings without a BAS, it is often accomplished by Contact Closure, where a wire delivers an analog signal from an occupancy sensor or NLC system to an HVAC VAV box or thermostat. Each signal uses its own uniquely placed wire.
 - New technology for digital plug-and-play NLC-HVAC integration in small commercial spaces is becoming available, such as wireless thermostats that support WiFi or Bluetooth mesh with commercial-grade cybersecurity.
- Clarifying Questions:**
 - Is an integration contractor available, who can provide the required integration?
 - Integration requires a certain amount of fixed overhead investment, regardless of the project size. Therefore, integration tends to be more readily feasible in large spaces, where fixed project costs can be amortized over a large area. For a small space, are there extenuating circumstances such as high energy intensity, extremely variable occupancy, technological leadership promotion, or new digital wireless thermostats, that will make integration feasible for your project?



Case Study Column Headings

Building Type

Lessons Learned

City

Project Controls

State

HVAC Type

Country

Occupancy/HVAC Schedule

Project Size (sqft)

Energy Saved

Building Characteristics

Payback (Years)

NC, MR, Retrofit (New Construction, Major Renovation, Retrofit) Utility Incentives

Systems Integrated

Project Date

Integration Purpose

Publish Date

Summary

Source Website

Project Decision Drivers/Objectives

Additional Website

Case Study Columns, First Section

	A	B	C	D	E	F	G	H	I
1	Building Type	City	State	Country	Project Size (sqft)	Building Characteristics	NC, MR, Retrofit	Systems Integrated	Integration Purpose
2	Retail	Durham	NC	USA	25,000	<ul style="list-style-type: none"> - One story building - 19,000 sqft retail; - 6,000 sqft office/warehouse 	New construction	NLC, HVAC	Scheduling
3	Office	New York City	NY	USA	42,000	High rise office in midtown Manhattan built in 1970's	Major renovation	PoE LLLC, HVAC, IoT	IoT
4	Hotel	Fort Worth	TX	USA	164,000	<ul style="list-style-type: none"> - 164 guest rooms - 16 floors - Historic 1929 building 	Major renovation	PoE LLLC, HVAC, IoT	IoT

Case Study Columns, Middle Section

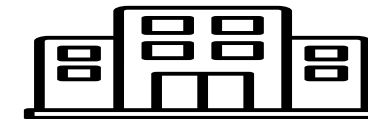
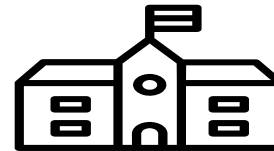
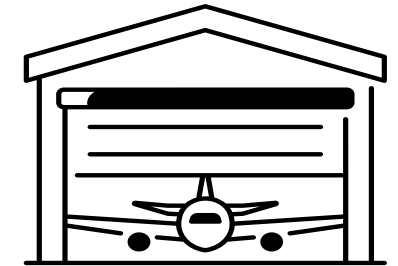
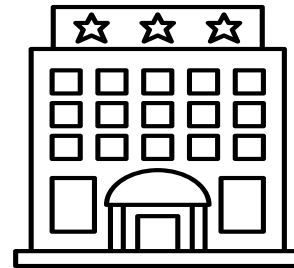
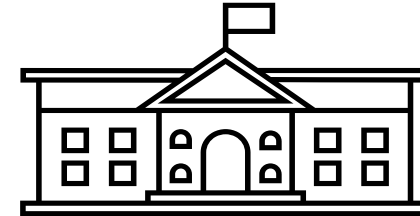
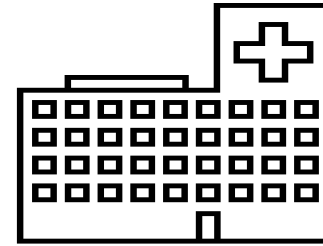
Summary	Project Decision Drivers/Objectives	Lessons Learned/Challenges	Project Controls
<ul style="list-style-type: none"> - A new Crate&Barrel store was built with an integrated BACnet control system designed for easy scheduling of store lighting and HVAC, including approximately 1,000 track lights and 120 tons of cooling 	<ul style="list-style-type: none"> - Customer and employee comfort - Area must be well-lit; HVAC has high heat load - Previous stores used separate control systems for lighting and HVAC, cumbersome and expensive 		<ul style="list-style-type: none"> - BACnet controls on all lighting and HVAC equipment. 29 devices and 2,715 points, including lighting zones, rooftop units, fans, gas-fired heater, wireless space temperature sensors, CO2 sensors - User-friendly web interface for seamless scheduling of lighting and HVAC systems - BACnet kWh meter
<ul style="list-style-type: none"> - The Penn 1 Plaza 1970's highrise office building in midtown Manhattan was renovated into a smart office building with fully interconnected subsystems using Power over Ethernet (PoE) technology - Dramatically improved workplace comfort, flexibility, and sustainability 	<ul style="list-style-type: none"> - Attract and retain talent - Advance net-zero sustainability goals - Achieve actionable data and insights across systems - Demonstrate ecosystem of PoE products 		<ul style="list-style-type: none"> - Power over Ethernet (PoE) control uses a single interface to optimize air quality, thermal comfort, daylighting, power consumption, cost, carbon footprint, etc. - Integrated building systems and data sources include lighting, HVAC, automated window shades, smart cameras, weather tracking, touchscreens, voice consoles; air temperature, humidity, quality
<ul style="list-style-type: none"> - An Art Deco landmark office building was renovated into a DC-powered 164-room luxury hotel smart building - Low voltage DC (Direct Current) Power over Ethernet (PoE) devices throughout guest rooms and common areas - High voltage DC power serves network switches - UL924 lithium ion battery system for enhanced energy management, reliability and backup power, instead of diesel generator 	<ul style="list-style-type: none"> - Historic preservation - Reduce carbon footprint - Lower electrical consumption - Connected building with marketable high-tech features 	<ul style="list-style-type: none"> - Repurposing older buildings into hotels can be cost effective and environmentally sound - Each PoE device is networked with its own IP address, enabling individual device control and monitoring to manage building energy consumption - Dedicated IT staff assists in operation and maintenance of the PoE and DC systems - DC and PoE for lighting, heating and cooling provided ease, affordability, and sustainability 	<ul style="list-style-type: none"> - PoE devices in guestrooms include LED lighting, motorized window treatments, electric smart mirror, digital shower system, minibar, occupancy sensors, smart door lock, IP phones - PoE devices in common areas include LED lighting, Wi-Fi access points, security cameras, hotel sound system speakers

Case Study Columns, Final Section

HVAC Type	Occupancy/ HVAC Schedule	Energy Saved	Payback (Years)	Utility Incentives	Project Date	Publish Date	Source Website	Additional Website
<ul style="list-style-type: none"> - Seven Roof-top Units - Three Exhaust Fans - 1 Gas-fired Unit Heater (warehouse) - Provides 120 tons of cooling 		<ul style="list-style-type: none"> - The control system and lighting re-design reduced energy usage from 12 W/ft² in previous stores to 6 W/ft² in this store. - HVAC costs are 70% lower compared to earlier stores. 			2010	2022	https://www.carrier.com/commercial/en/us/literature/case-studies/retail/crate-and-barrel/	
	- 79,500 occupants	<ul style="list-style-type: none"> - Reduced lighting consumption and costs by 50% or more - Reduced HVAC and lighting system use, power consumption, and cost 	- Near-immediate ROI.		2022	2022	https://www.cisco.com/c/en/us/solutions/collateral/enterprise-networks/dna-spaces/cisco-penn1-case-study.html?oid=csyswt029726	
<ul style="list-style-type: none"> - Variable Refrigerant Flow (VRF) ductless heat pump system with split distribution replaced hydronic heating with chiller cooling 		<ul style="list-style-type: none"> - Benchmarked energy use with ENERGY STAR Portfolio Manager (5/2021–4/2022). - ENERGY STAR score of 70, twenty points above the median for hotels. - Weather-normalized site EUI: 53.0 kBtu/ft². - Median site EUI for hotels (CBECS): 63.0 kBtu/ft², saving 10.0 kBtu/ft². 			2019	2022	https://www.mncee.org/power-over-ethernet-poe-technologies-hotels	

Case Study Building Types

- Healthcare
- Higher Education
- Hotel
- Industrial
- K-12 Education
- Office
- Retail



Project Templates

Task	Design/Specify		Procure				Install				Operations				Notes																	
	ARCHITECT	ELECTRICAL ENGINEER	MECHANICAL ENGINEER	LIGHTING DESIGN	TECHNOLOGY DESIGN	SYSTEMS INTEGRATOR	EQUIPMENT VENDORS	PROJECT MANAGER / OWNER'S REPRESENTATIVE	ARCHITECT	ELECTRICAL CONTRACTOR	MECHANICAL CONTRACTOR	TECHNOLOGY CONTRACTOR	SYSTEMS INTEGRATOR	PROJECT MANAGER / OWNER'S REPRESENTATIVE		ARCHITECT	ELECTRICAL CONTRACTOR	MECHANICAL CONTRACTOR	TECHNOLOGY CONTRACTOR	SYSTEMS INTEGRATOR	COMMISSIONING AGENT	PROJECT MANAGER / OWNER'S REPRESENTATIVE	EQUIPMENT VENDORS	SYSTEMS INTEGRATOR	FACILITIES MANAGER	FACILITIES ENGINEERS	PROJECT MANAGER / OWNER'S REPRESENTATIVE					
4 Lighting System																																
5 Luminaire Selection and Fixture Layout	C	C	C	R	C	C	C	A	C	R	I	C	C	A	C	R	I	C	C	A												
6 Luminaire Control Integration	C	C	C	R	C	C	C	A	C	R	I	C	C	A	C	C	I	R	C	A												
7 Luminaire Power Requirements	C	R	C	C	C	C	C	A	C	R	I	C	C	A	C	R	I	C	C	A												
8 Lighting Control System																																
9 CIN and SDO	C	C	C	R	I	C	C	A	C	R	I	C	C	A	C	C	I	R	C	A	C	R	A	I	I					Refer to ANSI/IES LP-16-22		
10 Lighting Control Zones	C	C	C	R	I	C	C	A	C	R	I	C	C	A	C	C	I	R	C	A	C	R	A	C	I							
11 Device Layout & Quantities	C	C	C	R	I	C	C	A	C	R	I	C	C	A	C	R	I	C	C	A												
12 HVAC System																																
13 HVAC Selection and VAV/Duct Layout	C	C	R	C	C	C	C	A	C	I	R	I	C	C	A	C	I	R	I	C	C	A										
14 HVAC Control Integration	C	C	R	C	C	C	C	A	C	I	R	I	C	C	A	C	I	C	I	R	C	A										
15 HVAC System Power Requirements	C	C	R	C	C	C	C	A	C	I	R	I	C	C	A	C	I	R	I	C	C	A										
16 HVAC Control System																																
17 CIN and SDO	C	C	R	C	C	C	C	A	C	I	I	C	C	A	C	I	C	I	R	C	A	C	R	A	C	I					Refer to ASHRAE Guideline 36-2021.	
18 HVAC Control Zones	C	C	R	C	C	C	C	A	C	I	I	C	C	A	C	I	C	I	R	C	A	C	R	A	C	I						
19 HVAC Control Device Layout & Quantities	C	C	R	C	C	C	C	A	C	I	I	C	C	A	C	I	R	I	C	C	A											
20 Technology Infrastructure (If, OI)																																
21 Infrastructure & Connectivity for Connected Control Systems	C	C	C	C	R	C	C	A	C	I	I	R	C	C	A	C	C	C	R	C	C	A										
22 Cyber Security Coordination	C	I	I	I	R	C	C	A	C	I	I	R	C	C	A	C	I	C	R	C	A										Refer to DLC NLCS.1 Technical Requirements.	
23 Control System Network Requirements	C	I	I	I	R	C	C	A	C	I	I	R	C	C	A	C	I	C	R	C	A											
24 Commissioning and Integration Process																																
25 Owner's Project Requirements	C	R	R	R				A																								
26 Control System Programming							C																									
27 Verification Commissioning																																
28 Energy Efficiency Incentives																																
29 Training		R	R	C	C	C	A		R	R			A																			
30 On-site, Commissioning (During Construction)																																
31 On-going Testing (During Operations)																																

The project team shall list all the performance outcomes for the individual project under procurement.

The contractor described in this section shall perform the role of the Master Systems Integrator (MSI). During the procurement process, the project team shall identify the sub-contractor to perform this specification and ensure the Division 25 responsibilities are achieved. The MSI is contracted to provide the DIV 25 specification requirements and manage all cross-domain coordination.

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

General and technical requirements for Networked Lighting Control integration with Building Automation System.

B. Scope

1. Procurement and installation of integrated systems shall follow Related Sections specifications including labor and materials. Include all components not specifically indicated or specified, but necessary to make the system function within the intent of the specification.
2. Communication network type may vary, based on the system design. MSI shall coordinate communication protocol requirements for integration. In this scope, integration refers to the NLC and the HVAC system and may include direct controller to controller, controller to supervisory controller and vice versa, and controller to BMS front end user interface software all using a standard open communications protocol such as BACnet.
3. MSI shall lead the effort to integrate the Lighting, HVAC and BMS Systems. Effort includes developing the integration plan, facilitating communication protocol meetings, tracking and follow-through with requests for vendor-specific information.
4. MSI shall coordinate with Owner's IT department for software on-boarding, network infrastructure requirements, network deployment and management, cybersecurity policies and requirements, and related OT/IT coordination requirements to accommodate project schedule.

C. Related Sections

1. Division 23
2. Division 26

1.2 ACRONYMS

- A. ANSI American National Standards Institute
- B. API Application Programmable Interface



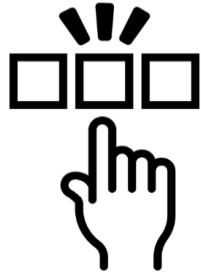
Toolkit Tour



Suggest changes to
info@designlights.org

Toolkit Goals

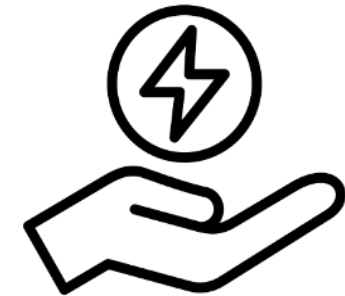
These tools will help you to



Choose appropriate projects



Collaborate better



Save energy

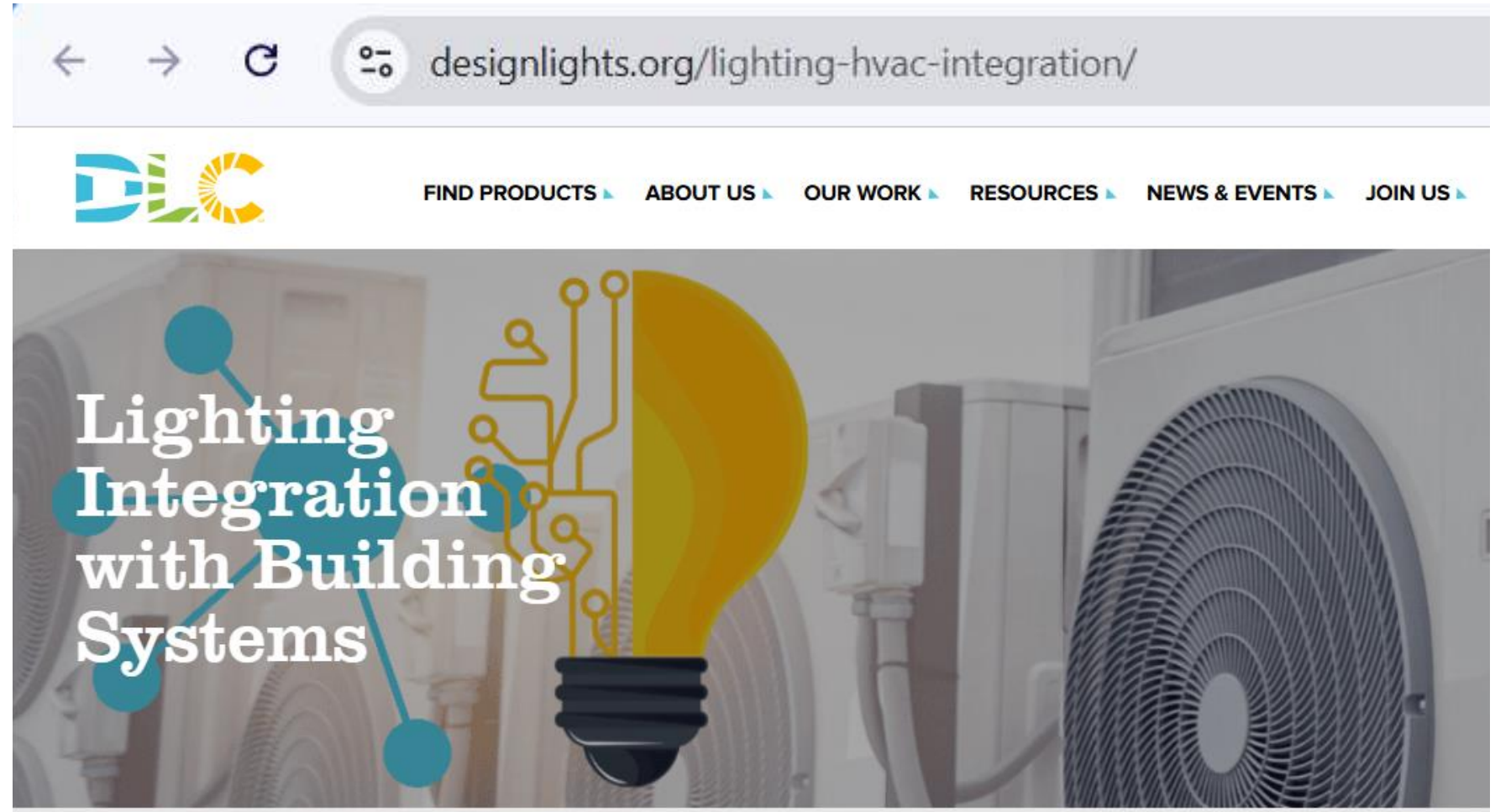
Agenda

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6. Questions and Answers

TOOLKIT



DLC NLC-HVAC Controls Integration Toolkit





HEARD AT THE SUMMIT

“

People aren't asking for integration, they are asking for positive outcomes, efficiency, and systems that work together.

”



**This is
Integrated
Automation**

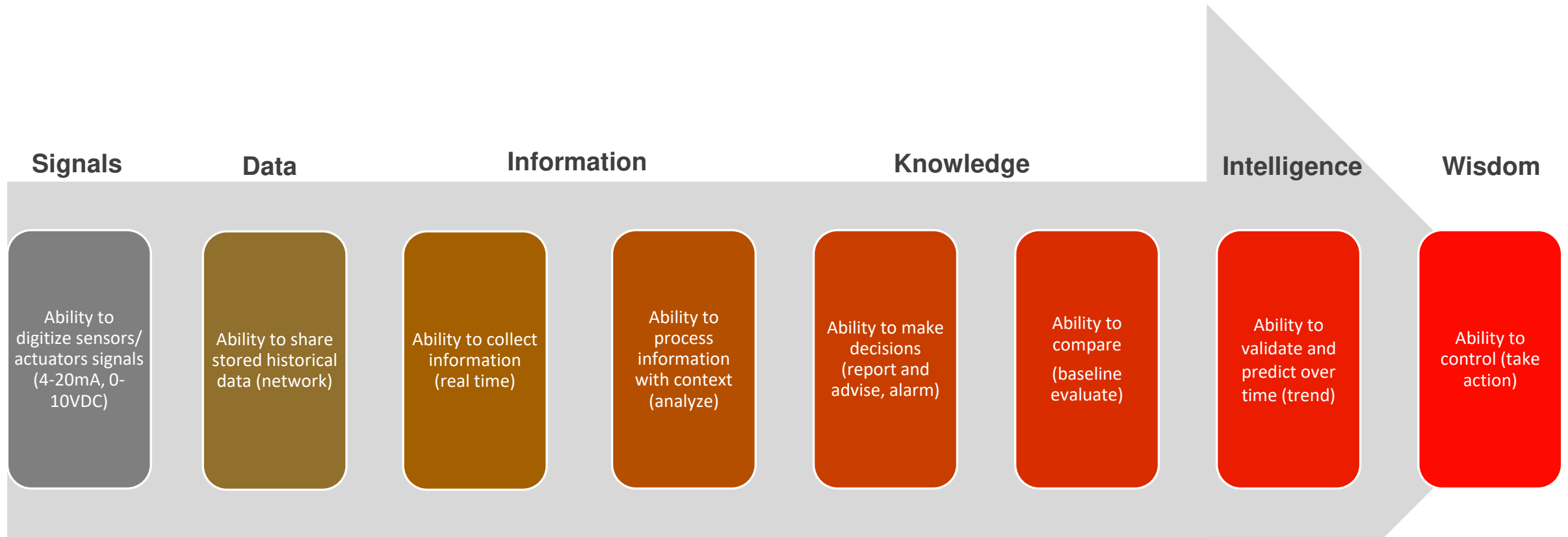
What Makes Systems Smart?

- Ability to communicate
- Ability to consume or produce “information”
- Ability to react/respond to system changes



Smart Building Systems Key Performance Indicators

Its all about the base...data!



Increasing data set context = greater value of the data

Definition – Smart Building

A smartly
designed
building

- Enhances the performance of the building
- Provides greater ease of operation over its life-cycle
- Minimize the long-term costs of facility ownership to owners, occupants and the environment
- Higher performing building
- All components of the building are integrated
- Improves operational performance
- Increases occupant comfort and satisfaction
- Provides the owner with systems, technologies and tools for better management
- Minimize energy consumption



Primary Project Goals:

Operational
Efficiency

Energy
Efficiency

Electrification

Decarbonization

Reduce Cybersecurity Risks

Building Control System Data

• Building Systems

- HVAC
- Lighting
- Fire
- Refrigeration
- Security/Life Safety
- Energy/Power
- Water/Steam/Gas
- Information Technology
- Plug Load
- Environmental
- Process

• Cross System Data Value

- Occupancy
- Alarming
- Events
- Energy usage
- Operational performance
- Process metrics
- Occupant comfort/productivity
- GHG/Carbon measurement
- Reliability/Resiliency

• Application Integration

- Alarm management
- Work order processing
- Fault Detection/Diagnostics
- Remote access
- Operational analytics
- Predictive maintenance
- Building modeling
- Adaptive control

- **Energy Management**
- **Grid integration**

- **DECARBONIZATION**

More actionable information = greater value, better decisions, better modeling



Control Systems Framework

OBJECTIVES

Energy efficiency and environmental sustainability

Reduced operational expense budgets

Greater desire for integration and interoperability

Advancements in front GUIs and analytics tools

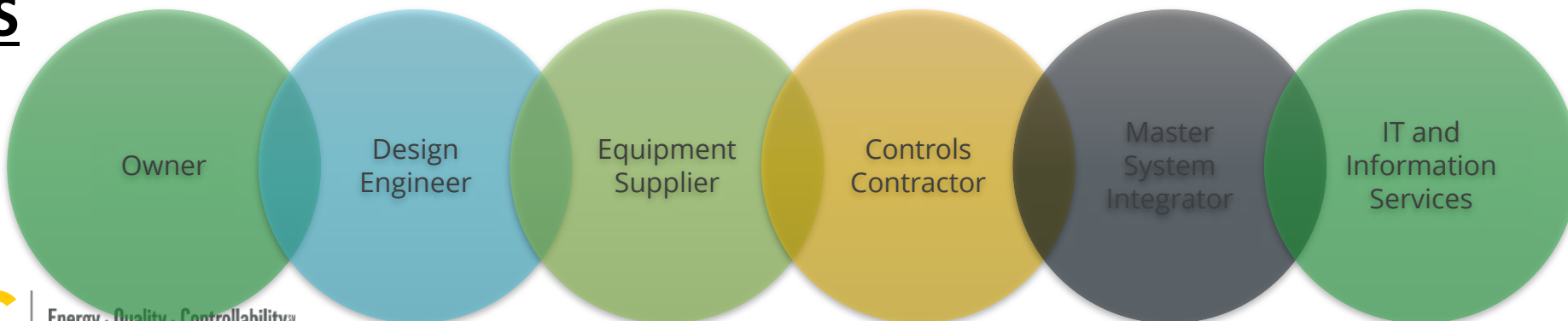
Requirements for open system and competitive bidding

Integration of the BAS with the IT infrastructure

COMPONENTS

- Alarming
- Scheduling
- Energy Metrics
- Analytics
- Configurable Rules Engine
- Optimization
- Trending, Graphing
- Reporting
- Data Imports and Exports
- Monitoring
- Graphical User Interface

TEAMS



Control System Design – What's in the Spec?

- Integration Requirements for All OT Systems
 - Monitoring, Alarming, Trending, Management
- Comprehensive BMS Front End Graphics
 - Organized according to O&M workflow
 - Assign priorities
 - Minimize complexity
 - Reduce the bells and whistles
 - Fancy graphics are nice for the first week
 - After that, give me the raw information quickly
 - Customizable by O&M staff
 - Training on adds, moves, and changes
- Documentation
 - Well documented manuals
 - Accurate as-built drawings
 - Accurate points lists
 - Accurate Sequence of Operation documentation
- Commissioning Requirements
- Cybersecurity Policy/Requirements

- Communication Protocol Standards
- Network Architecture, Drawings
- Labeling, Tagging, and Nomenclature
 - Site specific requirements
 - Provided by O&M, not by vendor or contractor
 - Part of commissioning validation
- Points Lists
 - Standard set of well defined lists
 - Identify range, units, types, alarm limits, update intervals, etc.
 - No custom points, all standard and exposed/documented
 - Included in spec and in O&M Manuals
- Network Connectivity and Responsibilities

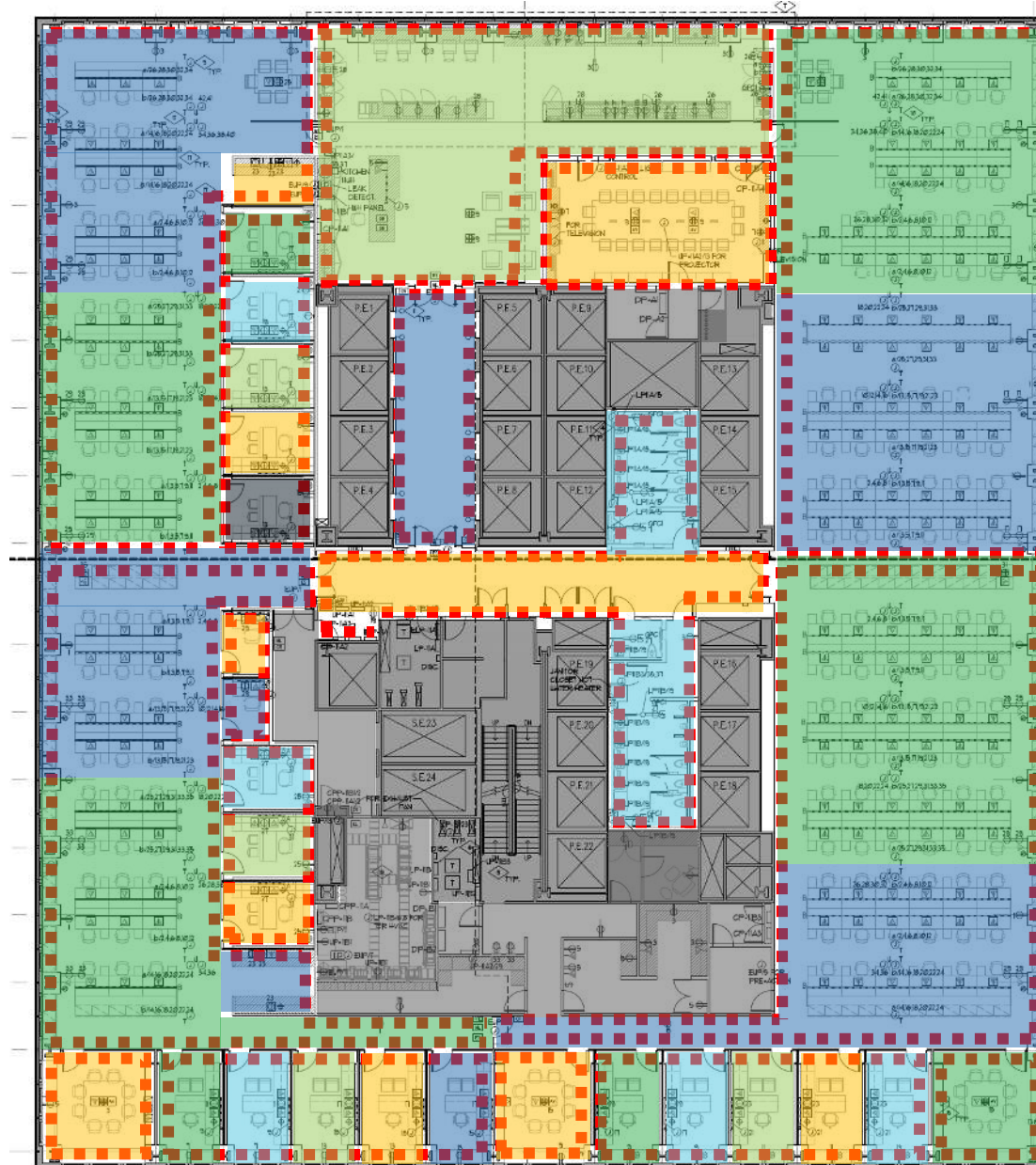


Lighting Zones



Lighting Zones

HVAC Zones



One, Unified, System

CAPEX – Capital Expenditures

+

OPEX – Operating Expenditures

=

Maximum Efficiencies, Optimal Outcomes

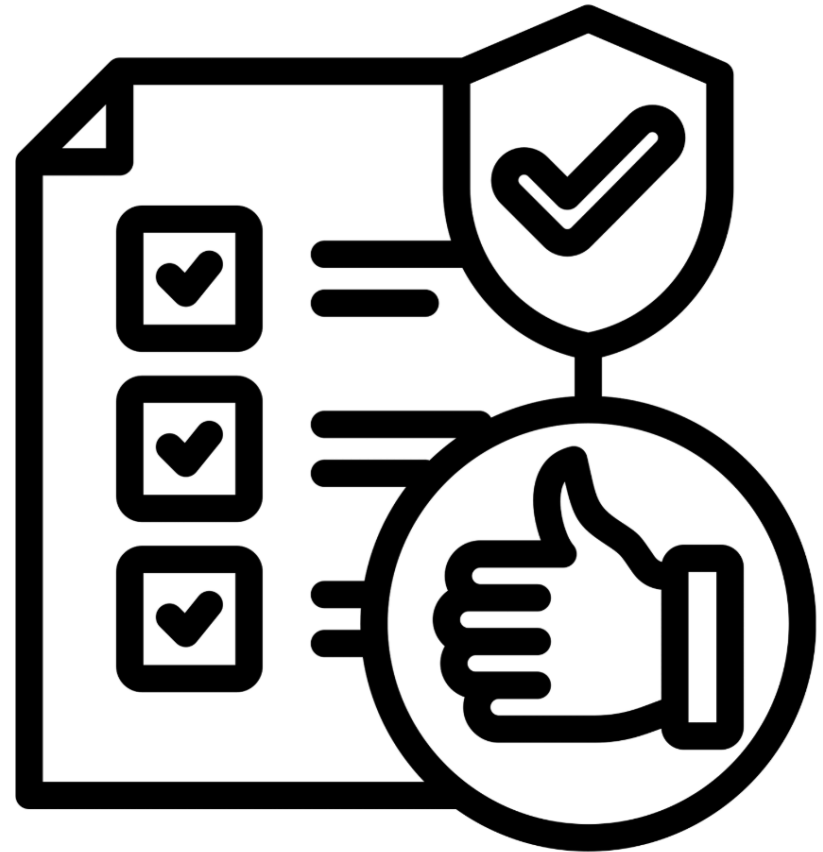


Agenda

1. Introduction
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- 4. Standardized Digital Protocols for NLC**
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Standardized, Certified Digital Protocols for NLC

1. DALI Alliance
2. Bluetooth® NLC
3. DLC's list of NLC Systems



0-10V Analog Performance is Unreliable

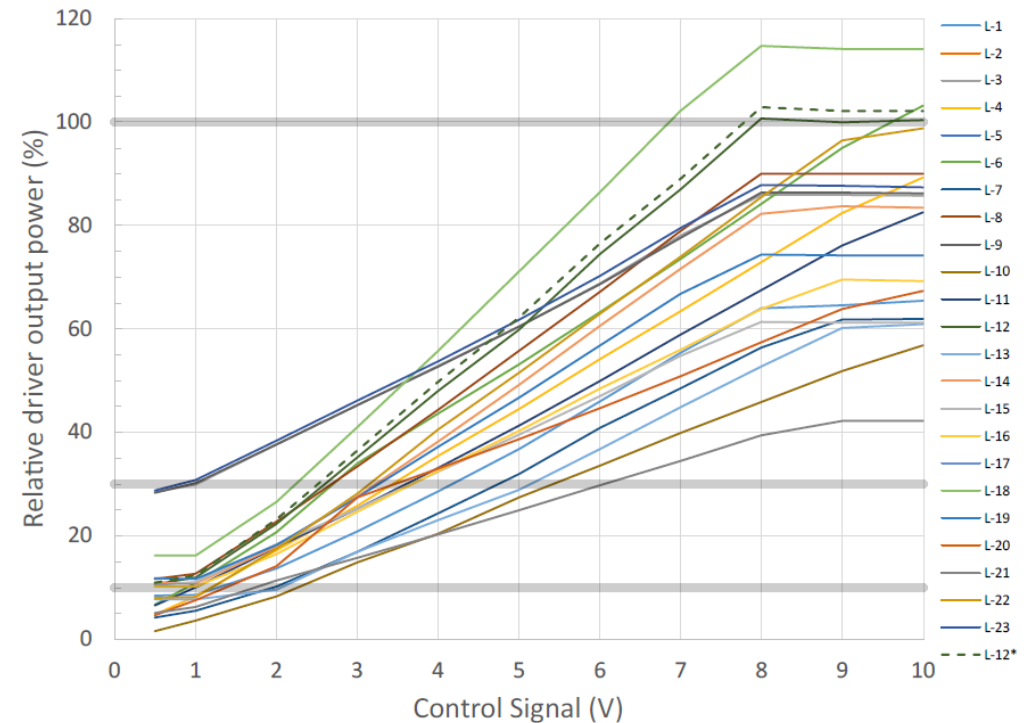
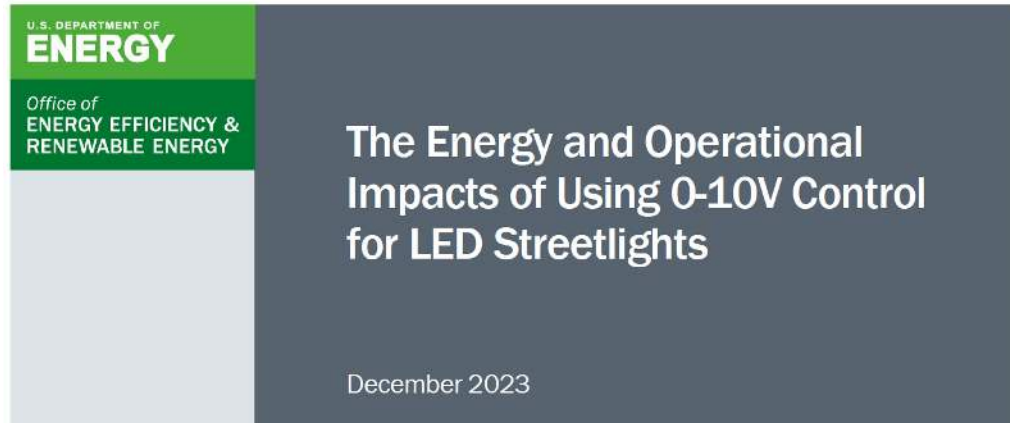


Figure 7. LED driver dimming curves, based on relative driver output power, as calculated from the rated driver efficiency. Horizontal threshold lines are highlighted at 10%, 30%, and 100% of rated maximum input power, and a thick red line shows an "expected" linear dimming curve. Two curves for L-12 (dark green, solid and dashed) show the response based on rated efficiency data found in two different manufacturer documents.

PNNL-32949

<https://www.pnnl.gov/publications/energy-and-operational-impacts-using-0-10v-control-led-streetlights>

Standardized Digital Data: DALI Alliance



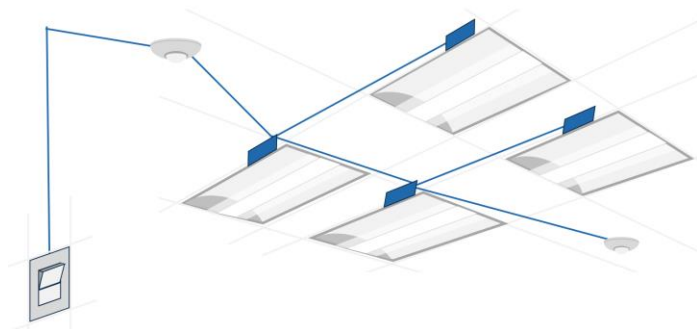
Wired network
BETWEEN luminaires,
sensors, wall-stations,
gateways...



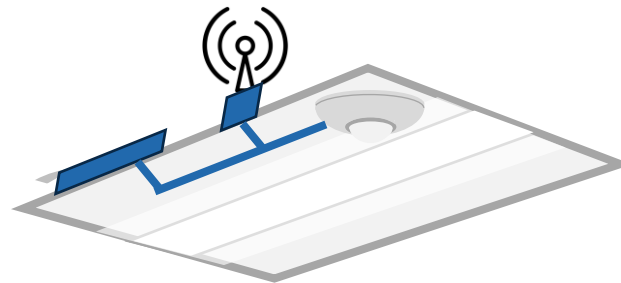
Wired network
WITHIN a luminaire:
drivers, sensors, controllers
(ANSI C137.4)



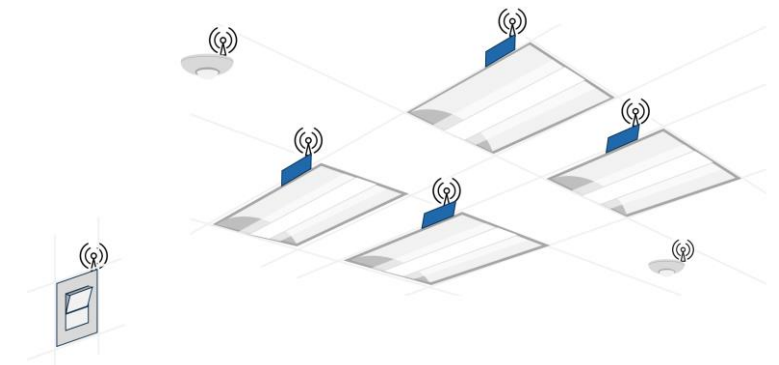
Wireless network
BETWEEN luminaires,
sensors, wall-stations,
gateways...



2017

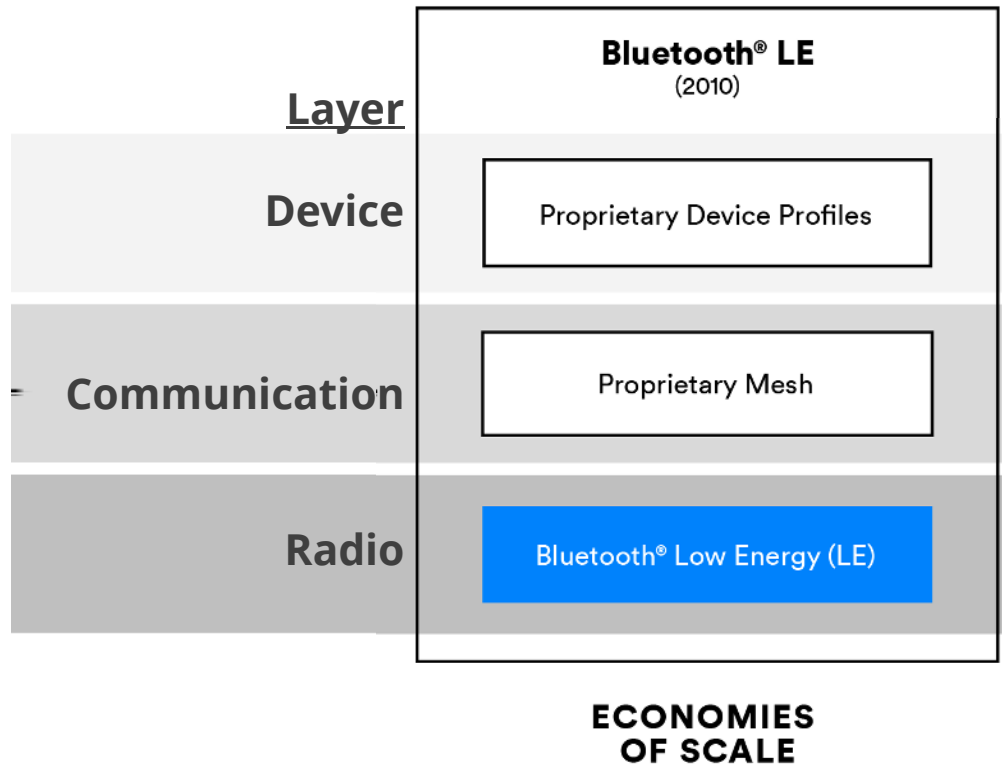


2019

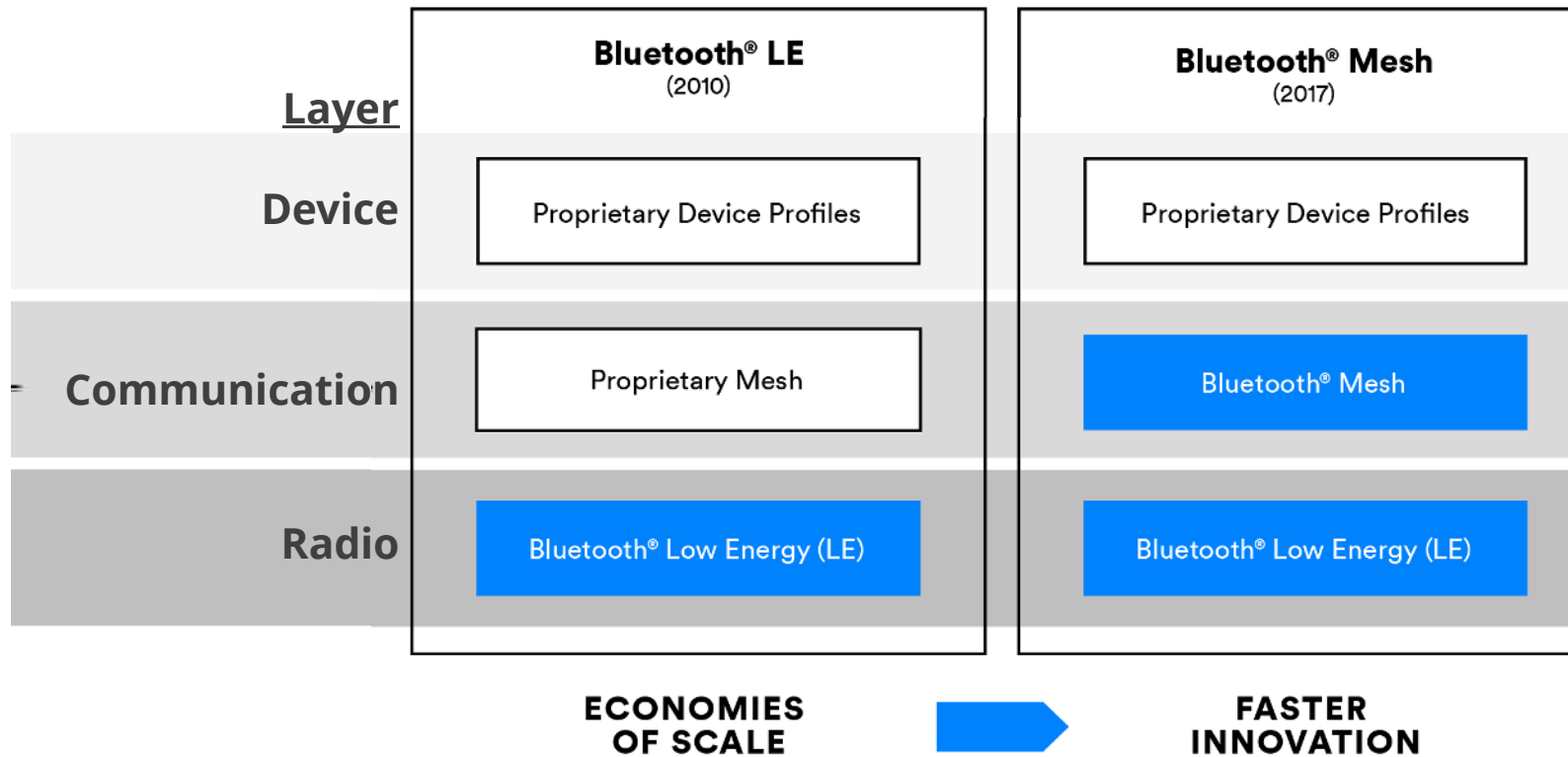


2021

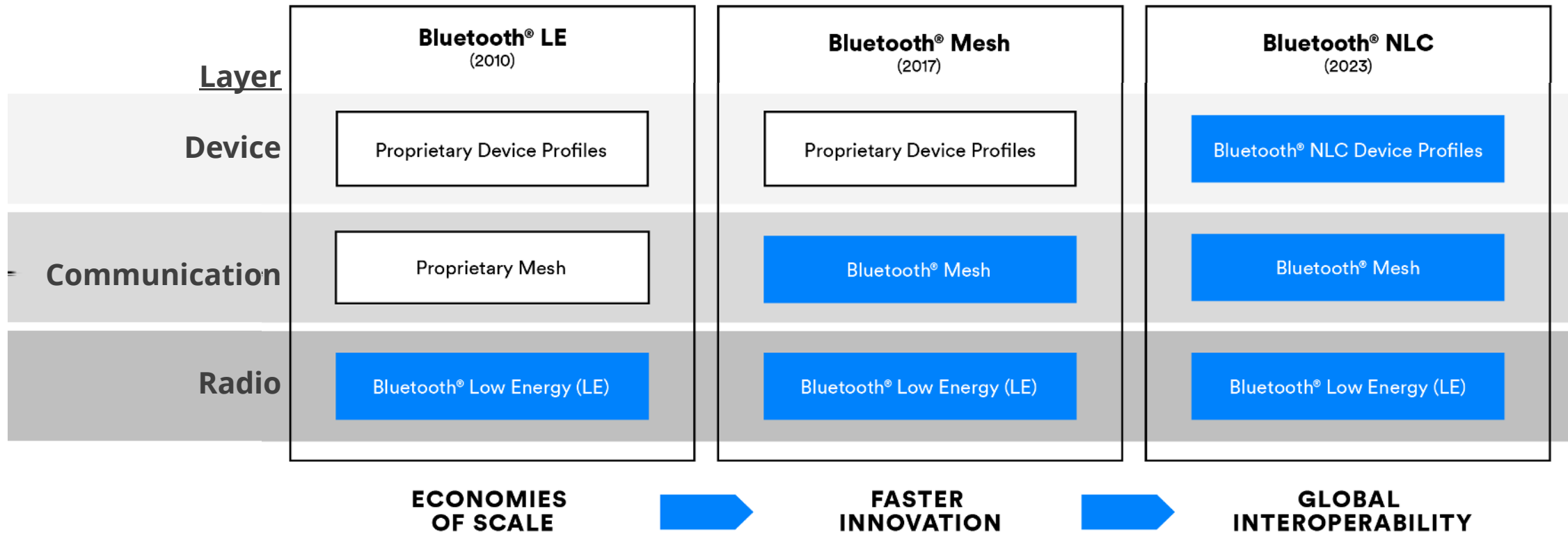
Standardized Digital Data: Bluetooth® Networked Lighting Control (NLC)



Standardized Digital Data: Bluetooth® Networked Lighting Control (NLC)

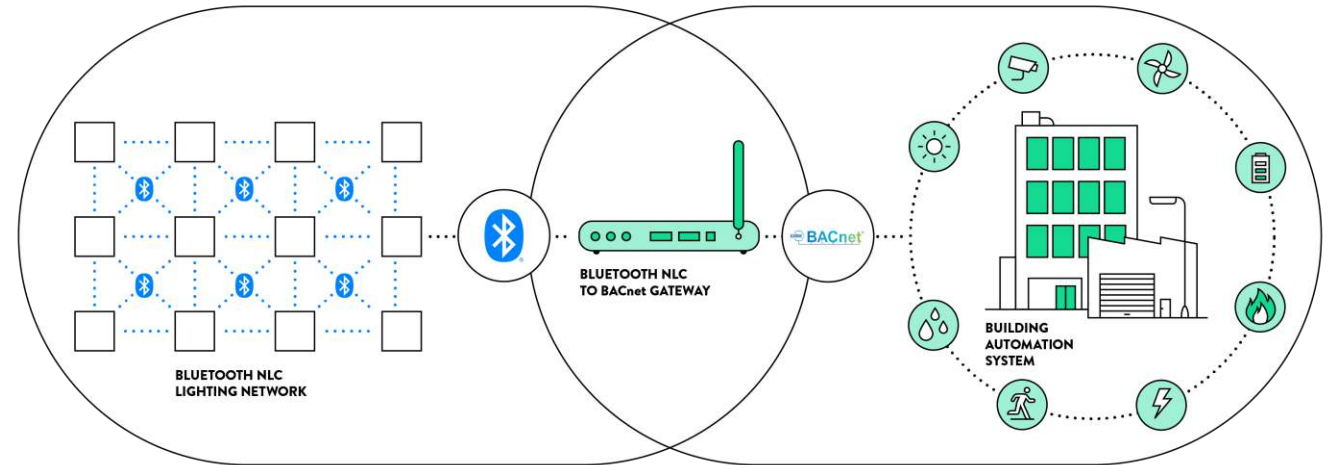


Standardized Digital Data: Bluetooth® Networked Lighting Control (NLC)

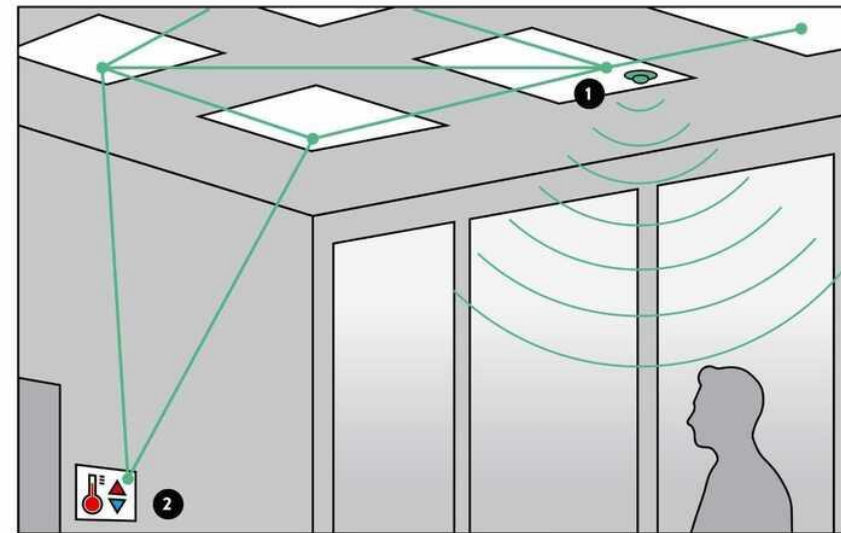


Bluetooth® NLC ↔ HVAC Integration Options

- Large buildings / buildings with BAS
 - Bluetooth NLC to BACnet gateway



- Small buildings / buildings without BAS
 - Bluetooth – enabled thermostats
 - Direct communication between NLC sensors and thermostats



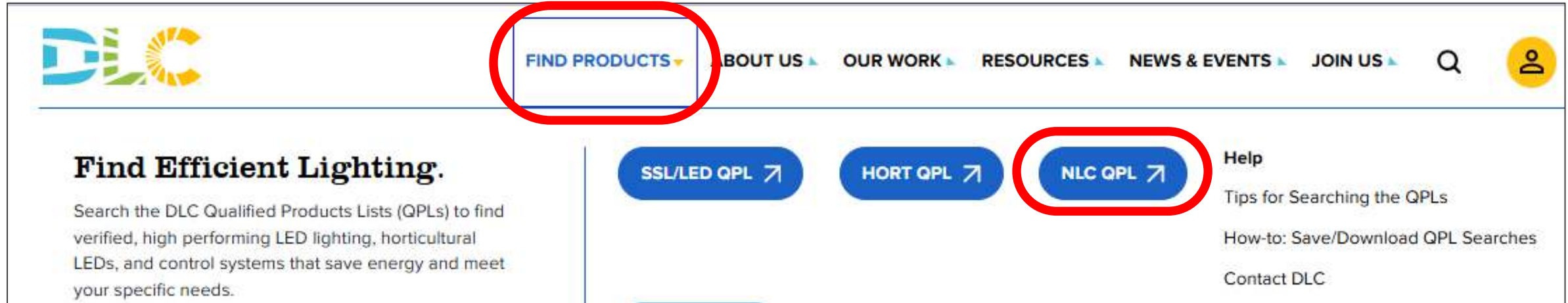


Standardized Data: DLC's list of Networked Lighting Control Systems


NLC system capabilities relevant to integration

- Networking of Luminaires and Devices
- Occupancy Sensing
- Cybersecurity
- Remote Diagnostics
- External Systems Integration

Standardized Data: DLC's list of Networked Lighting Control Systems



The screenshot shows the top navigation bar of the DLC website. The 'FIND PRODUCTS' link is highlighted with a red circle. Below the navigation bar, there is a section titled 'Find Efficient Lighting.' with a description: 'Search the DLC Qualified Products Lists (QPLs) to find verified, high performing LED lighting, horticultural LEDs, and control systems that save energy and meet your specific needs.' To the right of this text are three buttons: 'SSL/LED QPL', 'HORT QPL', and 'NLC QPL'. The 'NLC QPL' button is circled in red. Further to the right is a 'Help' section with links: 'Tips for Searching the QPLs', 'How-to: Save/Download QPL Searches', and 'Contact DLC'.

FIND PRODUCTS ▾ ABOUT US ▾ OUR WORK ▾ RESOURCES ▾ NEWS & EVENTS ▾ JOIN US ▾ Q 

Find Efficient Lighting.
Search the DLC Qualified Products Lists (QPLs) to find verified, high performing LED lighting, horticultural LEDs, and control systems that save energy and meet your specific needs.

[SSL/LED QPL ↗](#) [HORT QPL ↗](#) [NLC QPL ↗](#)

Help
[Tips for Searching the QPLs](#)
[How-to: Save/Download QPL Searches](#)
[Contact DLC](#)



You have 0 saved items

Save Search Criteria View Saved Searches

Listed Products

Manufacturer filter this list

Brand filter this list

Ease of Implementation

Technical Requirements Version

Indoor Scope

Outdoor Scope

Advanced Capabilities

User Interface

Integral Controls

Wired/Wireless Communication

Search by system name, manufacturer, brand, or product ID

Search Tip: For an exact search, use quotes around the search term (ex. "PVO5LXDK").

Prev 1 2 3 4 Next

Viewing 1-25 of 90 results

Add All Results to My List

IntrinsiX Xone Add to my list

Manufacturer: IntrinsiX Lighting
Brand: IntrinsiX Xone

Outdoor Scope: Structured Parking,Area/Building
Exterior/Parking,Streetlight (residential streets)
Technical Requirements Version: 5.0

Genio Add to my list

Manufacturer: Standard Products Inc.
Brand: Stanpro

Outdoor Scope: Structured Parking,Area/Building
Exterior/Parking,Streetlight (residential streets)
Technical Requirements Version: 5.0

LumaLinx Add to my list

Manufacturer: Jaykal LED Solutions,Inc.
Brand: LumaLinx

Indoor Scope: Portfolio/Enterprise,Whole
Building,Room or Zone,Structured Parking
Technical Requirements Version: 5.0

CONTROLLED Add to my list

Manufacturer: RAB Design Lighting

Outdoor Scope: Structured Parking,Area/Building



Levin Nock
Log Out

Home / DLC Qualified Product Lists / Networked Lighting Controls

You have 0 saved items

Save Search Criteria

View Saved Searches

Listed Products

Manufacturer

filter this list

Brand

filter this list

Search by system name, manufacturer, brand, or product number



Search Tip: For an exact search, use quotes around the search term (ex. "PVO5LXDK").

Prev

1

2

Next

Viewing **1-25** of **31** results

Add All Results to My List

Active Filters

Advanced Capabilities: Integration with BACnet systems

HY NLC

Add to my list



Levin Nock

Log Out

Home / DLC Qualified Product Lists / Networked Lighting Controls

You have 31 saved items

DOWNLOAD MY LIST

Save Search Criteria

View Saved S

Listed Products

Manufacturer

filter this list

Brand

filter this list

Search by system name, manufacturer, brand, or proc



Search Tip: For an exact search, use quotes around the search term (ex. "PVO5LXDK").

Prev

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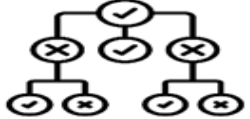
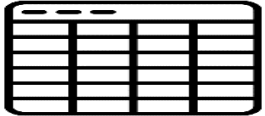

SUMMARY

- ✓ Networking
- ✗ Traffic Sensing
- ✓ High-End Trim
- ✓ Individual Luminaire Addressability
- ✓ Control Persistence
- ✓ Energy Monitoring
- ✓ User Interface
- ✓ Personal Control
- ✓ Plug Load Control
- ✓ Emergency Lighting
- ✓ Color Changing/Tuning
- ✓ Occupancy Sensing
- ✓ Daylight Harvesting
- ✓ Zoning
- ✓ Continuous Dimming
- ✓ Scheduling
- ✗ Remote Diagnostics
- ✓ Luminaire Level Lighting Control (LLLC)
- ✗ Load Shedding/Demand Response
- ✓ External Systems Integration
- ✓ Cybersecurity
- ✓ Scene Control

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Toolkit Files

1	Handbook	PDF	
2	Decision Tree	PDF	
3	Case Studies	Excel	
4	Responsibility Matrix	Editable Excel	WHAT? ?WHO!
5	Project Template	Editable Word	



You have 0 saved items

Save Search Criteria View Saved Searches

Listed Products ▾

Manufacturer (+) filter this list X

Brand (+) filter this list X

Ease of Implementation (+)

Technical Requirements Version (+)

Indoor Scope (+)

Outdoor Scope (+)

Advanced Capabilities (+)

User Interface (+)

Integral Controls (+)

Wired/Wireless Communication (+)

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CONTROLLED

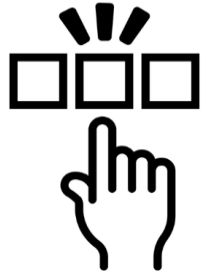
Add to my list

Manufacturer: RAB Design Lighting

Outdoor Scope: Structured Parking,Area/Building

Toolkit Goals

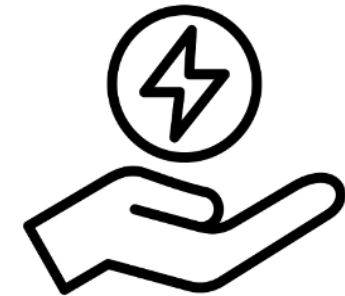
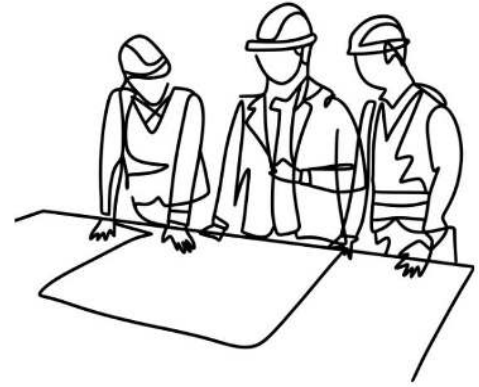
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TOOLKIT



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- Levin Nock

