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THE STANDARD FOR LIGHTING MANAGEMENT QUALITY SINCE 1953

SPRING SEMINAR

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NALMCO 2023 LEARNING LAB

Demystifying the complexity of Networked Lighting Controls (NLCs)

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Agenda

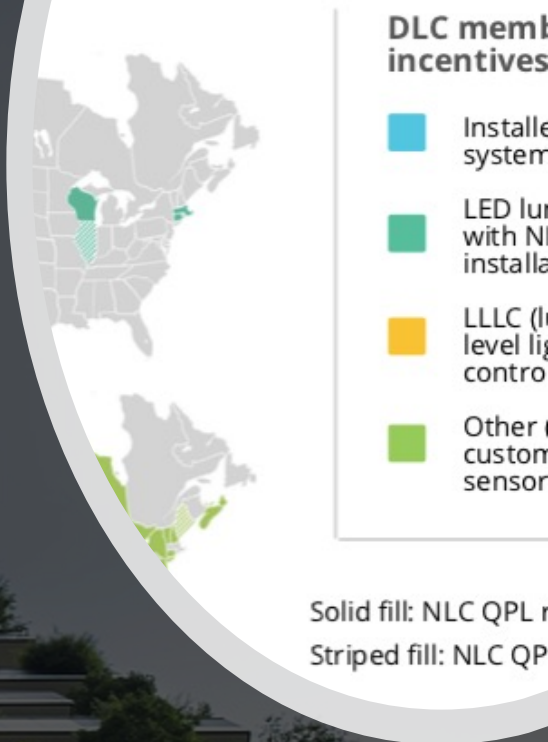
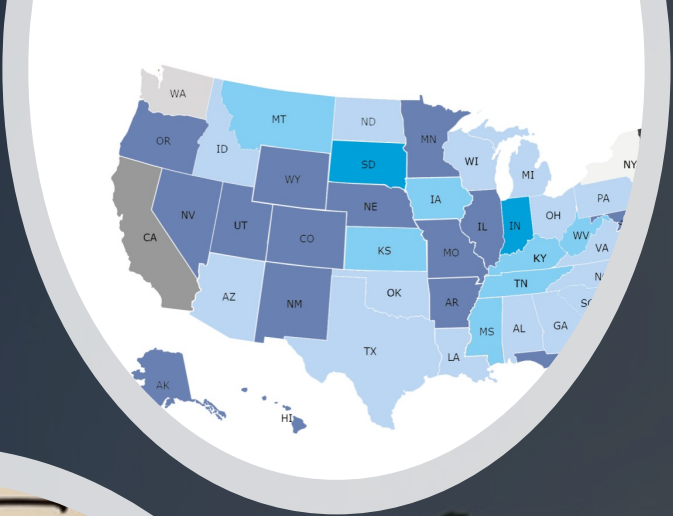
- What are NLCs?
- Why NLCs?
- How to simplify?
 - Audits
 - Designs
 - Installation
 - Start-up
 - Documentation
- Case Study
 - Problems
 - Solutions
 - Results

Network Lighting Controls

Combination of lighting & plug load controllers, sensors, wall stations and other integration related devices that communicate amongst each others. While zone-based hardwire lighting control platforms are still frequently deployed, market is rapidly moving toward lighting systems with **wirelessly networked addressable luminaires** and control devices



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ETW
 V
 INVESTM

6 key reasons for NLCs?





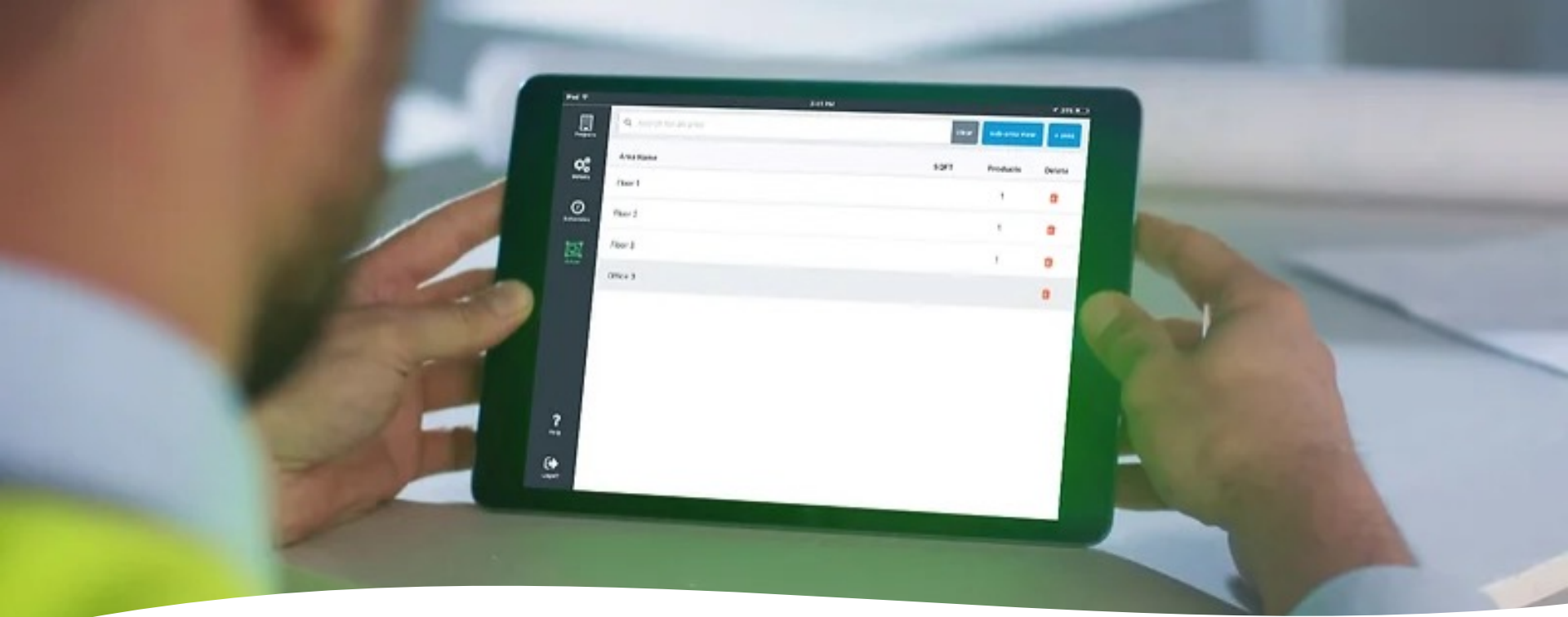
**KEEP IT
SIMPLE**

7 best practices for successful NLC implementations

- Audit
- SOO & CIN
- Design
- Product & Technology
- Pre-install meeting
- Installation
- Start-up



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Auditing for Controls

- Room Dimensions
- Ceiling Height & Access to the ceiling
- No. of circuits per room/area
- Window location, height & daylighting zone(s)
- Teacher's desk location in classrooms
- No. of switches per room & Single Pole vs. 3-way



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Sequences of Operation (SOO) & Control Intent Narratives (CIN)

LIGHTING PRACTICE STANDARDS: LIGHTING DESIGN, ENGINEERING, AND SPECIFICATIONS

- SIN = The WHAT of Controls
 - **Common Language**, like:
 - We need Dimmer inside Classrooms for teachers
 - Sensors to turn lights off
 - Want daylight harvesting
- SOO = The HOW of Controls
 - Gives you the **specifics** to tell you how **to program the system**. For instance:
 - Press the switch to turn lights on when entering a room
 - Lights will go on to 80% max. brightness (high end trim)
 - Sensors will automatically dim lights down to 20% after 20min of no activity and will turn lights off 10min later



Design Best Practices

- Equipment vs. **labor cost**
- **Future proofing** vs. Today's needs

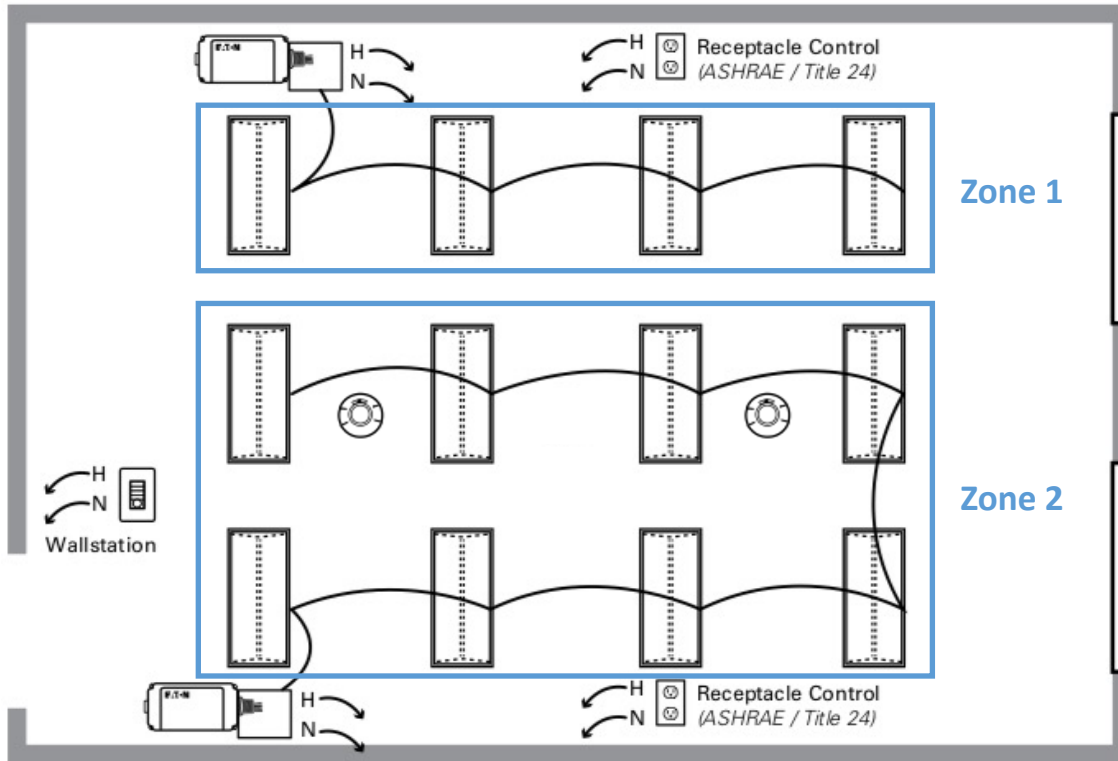


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Zone-based designs (Good)

One Controller & One Switch per Switch leg
One of few sensors per room



- Lowest Equipment Cost
- Known Design Practice
- Effective when space layout are not likely to change
- Possible lowest system programming cost

- Highest Labor Cost
- Consider Occupancy & possibly daylighting sensor placements, and number of zones
- Rewiring required if layout change

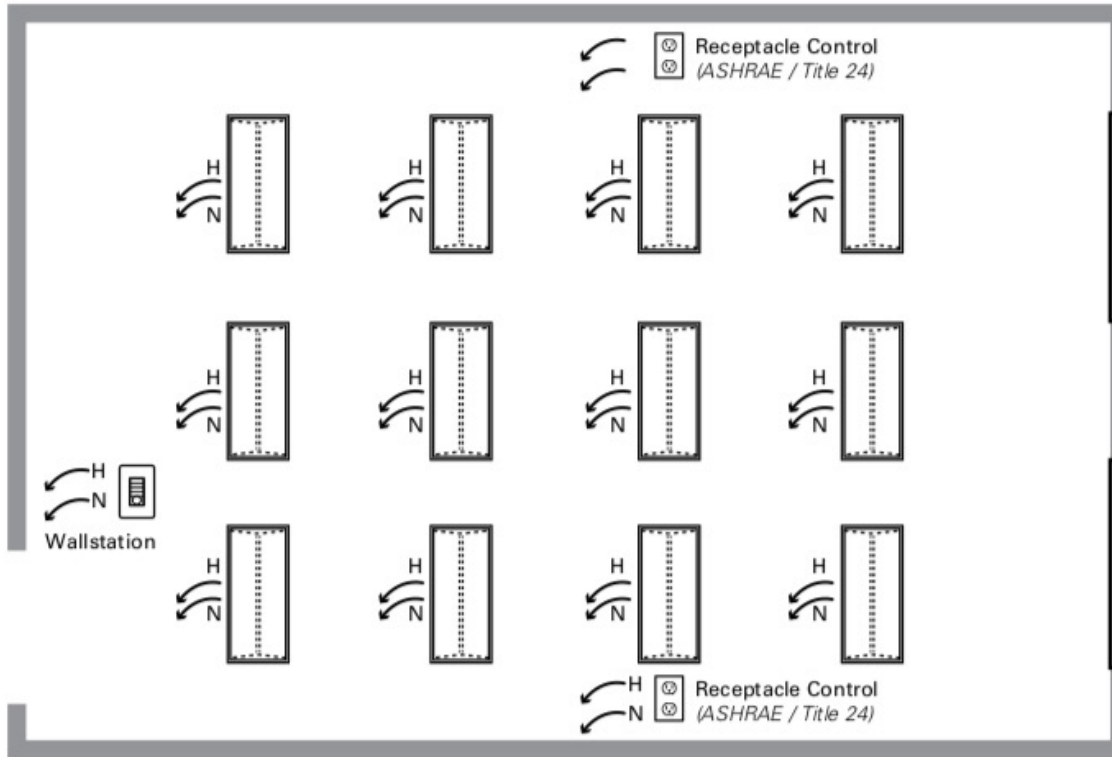


Hybrid designs (Better)

One Integrated Controller per fixture

One Switch per Zone

One of few sensors per room



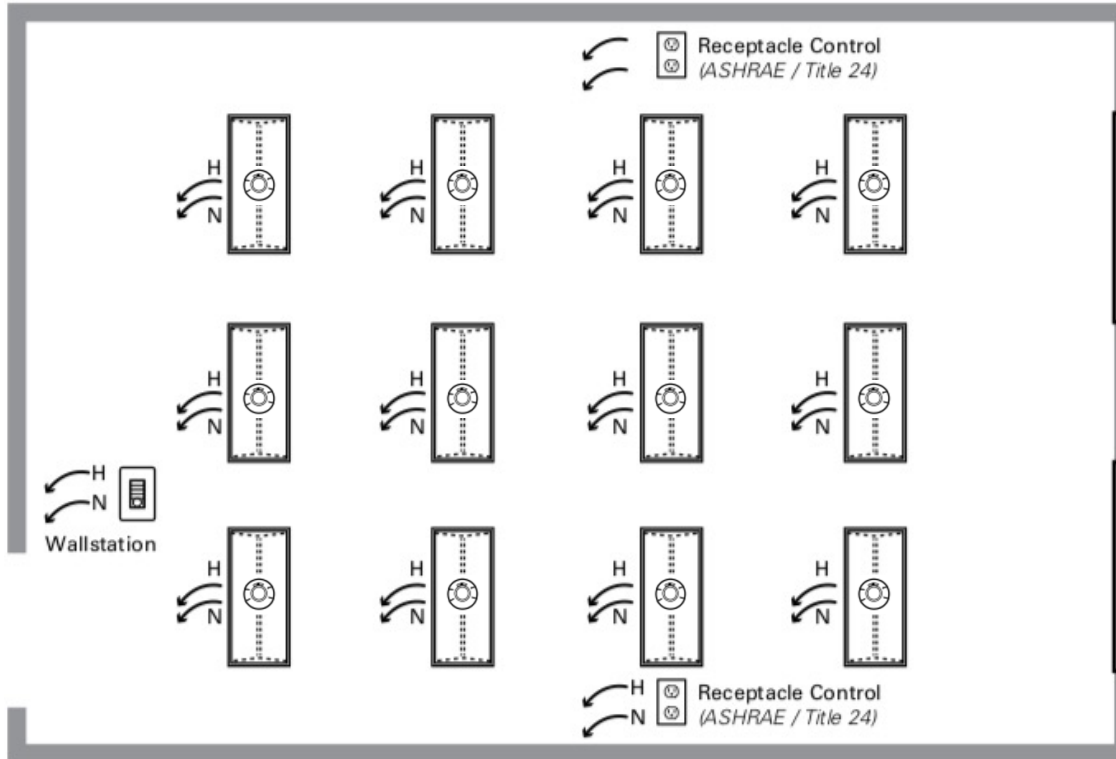
- Avg. Equipment Cost
- Eliminate significant onsite labor
- Effective when no ceiling access

- Avg. Labor Cost
- Consider Occupancy & possibly daylighting sensor placements
- Possible higher system programming cost



LLLCs (Best)

One Integrated Controller + Sensor per fixture
One Switch per Zone



- Lowest Onsite Labor Cost
- No need to think about sensor placement
- Effective when no ceiling access
- Qualify for LLLC rebates

- Highest Material Cost





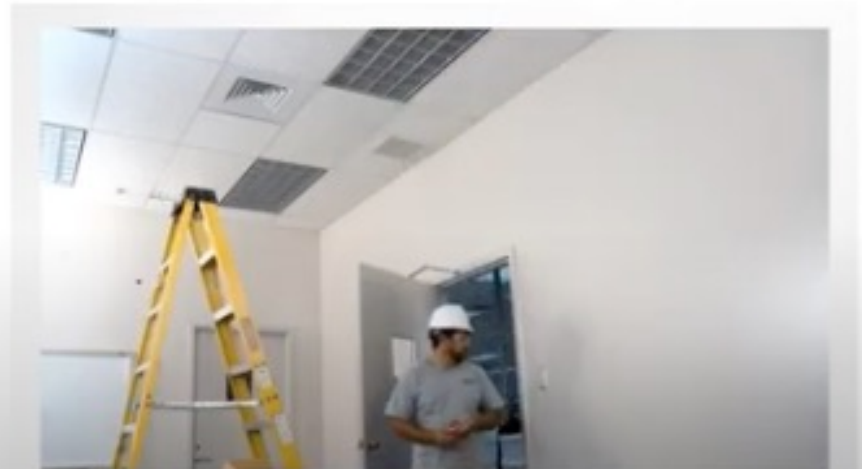
Product & Technology Selection

- Wired vs. **Wireless**
- Hardware vs. Software Centric

Wireless



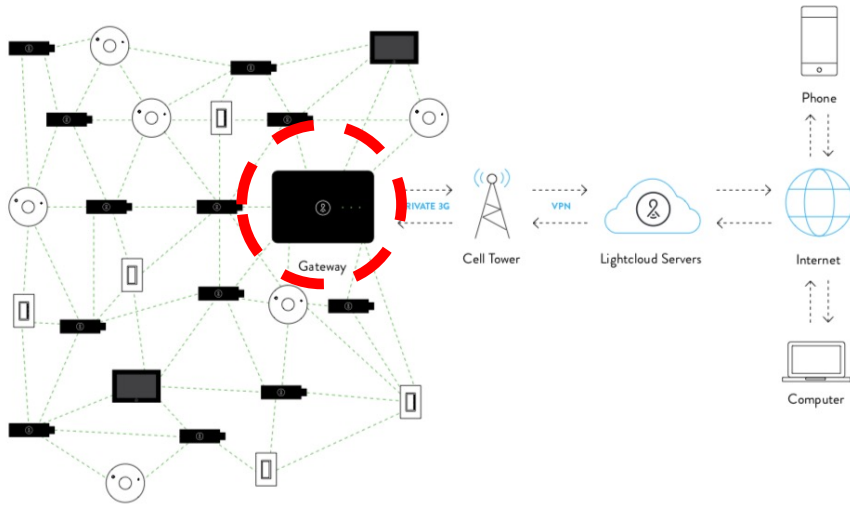
Wired



Wireless technologies have drastically improved over the past 10-20 years and are now robust and viable in non-Residential Applications

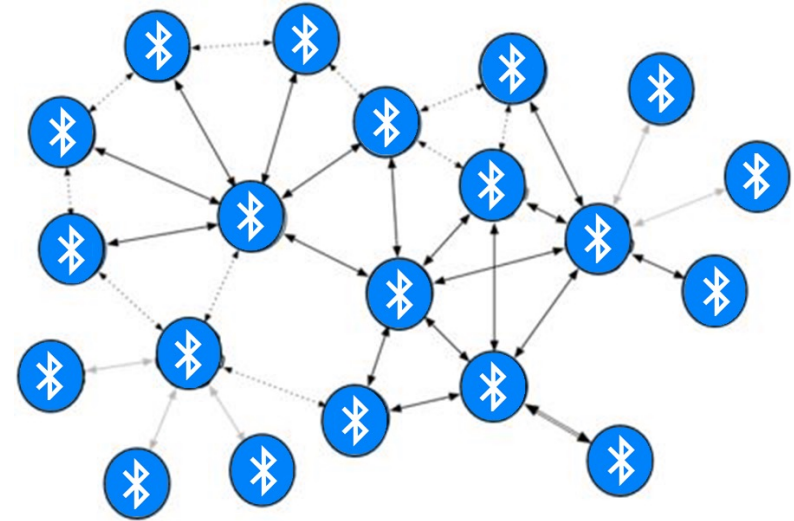
Less is More...

Traditional **Gateway**-based NLCs



- Optional (rare) or Mandatory
- Simple point of failure
- Capacity limitations (design)
- Range limitations (design & install)
- High Cost

vs. Bluetooth Mesh **Gateway-FREE** NLCs



- Eliminate Gateway but can it scale?
- Proprietary vs. Fixture Agnostic?
- Integrate with BMS?





Pre-install meeting

Slow down before you accelerate

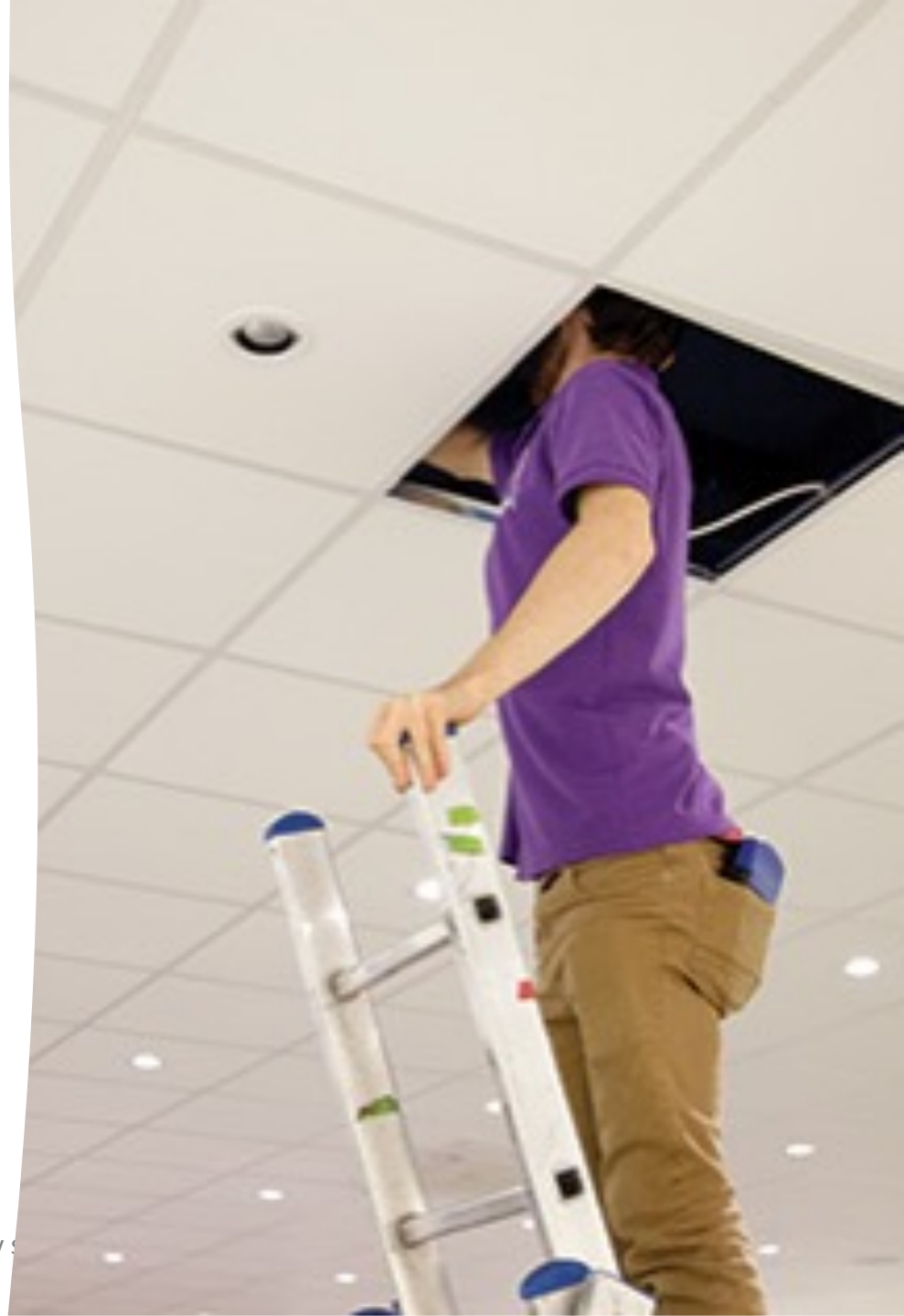
- Answer any questions from the installers
- Set expectations and responsibilities with all shareholders

Installation

- Work with lighting and control partners that have tested product combabilities
- Demand your lighting and control partners to pre-install at the factory the controls to minimize on-site labor

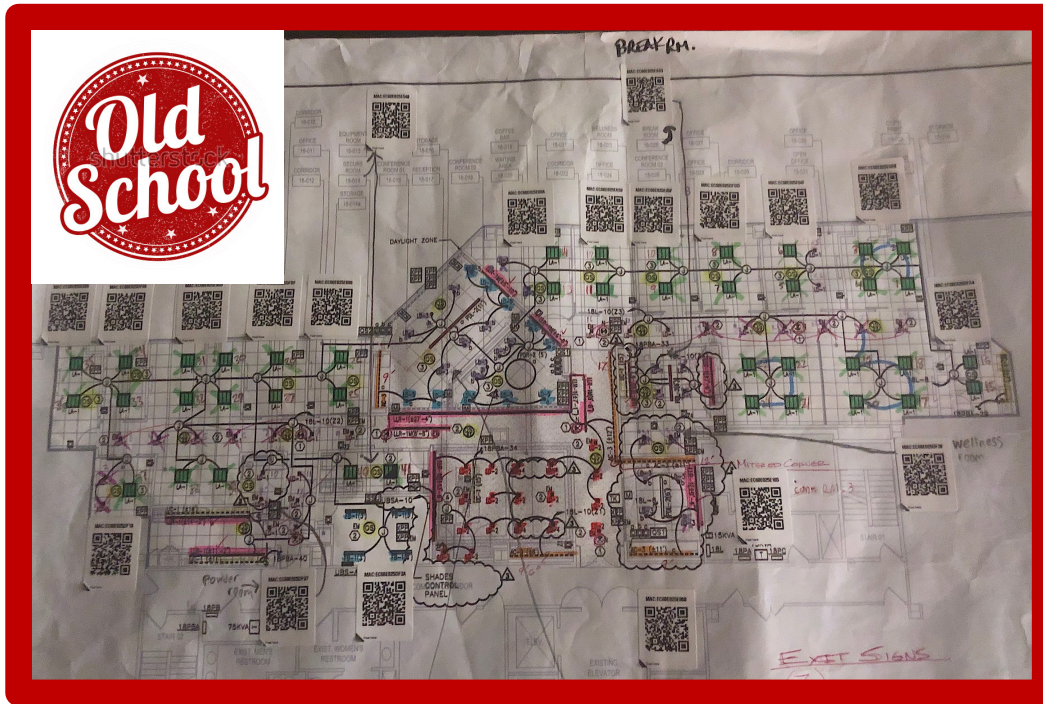


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Device Location

Sticker Map



Digital Scanner



Programming/Start-Up

On-site



Remote/Off-site



Lower
Programming Cost



Faster Response
Time



Less Disruption to
Occupants



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DOE ILC 2022 Award Winning Project...

- Project Location: Lansing, MI
- K-12 Holt School District; 9 schools
- 340,000sqft High School only
- 10,000+ fixtures
- ~8,000 Bluetooth Lighting Controls
- Commissioning done while kids were in school



**RECOGNIZED
PARTICIPANT**



Problems



Budget Constraints

- Insufficient Mileage Tax Bond
- Without External fundings School would have to cut measures out (eg. Lighting Controls) BUT would fail to meet school district sustainability goals

A 3D bar chart with a red arrow pointing upwards, labeled 'Energy Costs'. The chart shows a series of bars of increasing height, with a large red arrow pointing upwards from the bars. The background is a light blue and yellow grid.

Energy Costs

Increasing Energy Cost

- Utility Bill & Budget going up
- Pulling money out of education related investments
 - Hiring new teachers
 - Paying Teacher's bonus
 - Buying Chromebooks & misc. school supplies



Hiring Freeze & Reduced Maintenance Budget

- Staff stretched thin
 - Replacing broken light bulbs & ballasts
 - Cleaning fixtures (bugs)
- Not helping teachers with education-related maintenance



Limited Space Conversion Capabilities

- Classrooms frequently reconfigured
 - Classrooms -> Office
 - Classrooms -> Special Needs Classrooms
- Existing Lighting too Static and Lighting Controls are antiquated



Solutions

Financing

- On-Bill Financing
- Property Assessed Clean Energy
- Energy Savings Performance Contracting - ESPC
- Energy as a Service - EaaS
- Decarbonization as a Service - DaaS



Utility Rebates

- Energy Data to compare the before/after
- Based on kWh saved (\$0.25) using NLCs as opposed to kW reduction if LED retrofit only
- IRA Incentives – update to 179D tax code

The logo for Consumers Energy, featuring the company name in white text on a blue background with a white swoosh underneath.

Consumers Energy



LED Lighting

- Retrofit Kits
 - Minimized Onsite Labor
 - Reduce “cleaning” time working under the ceiling
- CCT Selectable





Network Lighting Controls

- Followed Best Practices

- Audit focused on sensor & dimmer counts (hybrid design)
- Documented CIN & COO
- Open communication between Contractor, Espen and Avi-on
- 5 SKUs & No-gateway (Wireless Bluetooth Mesh Technology)
- Avi-on Pre-programmed devices
- Espen installed controls at their factory
- Contractor scanned bar codes
- Avi-on programmed the system remotely

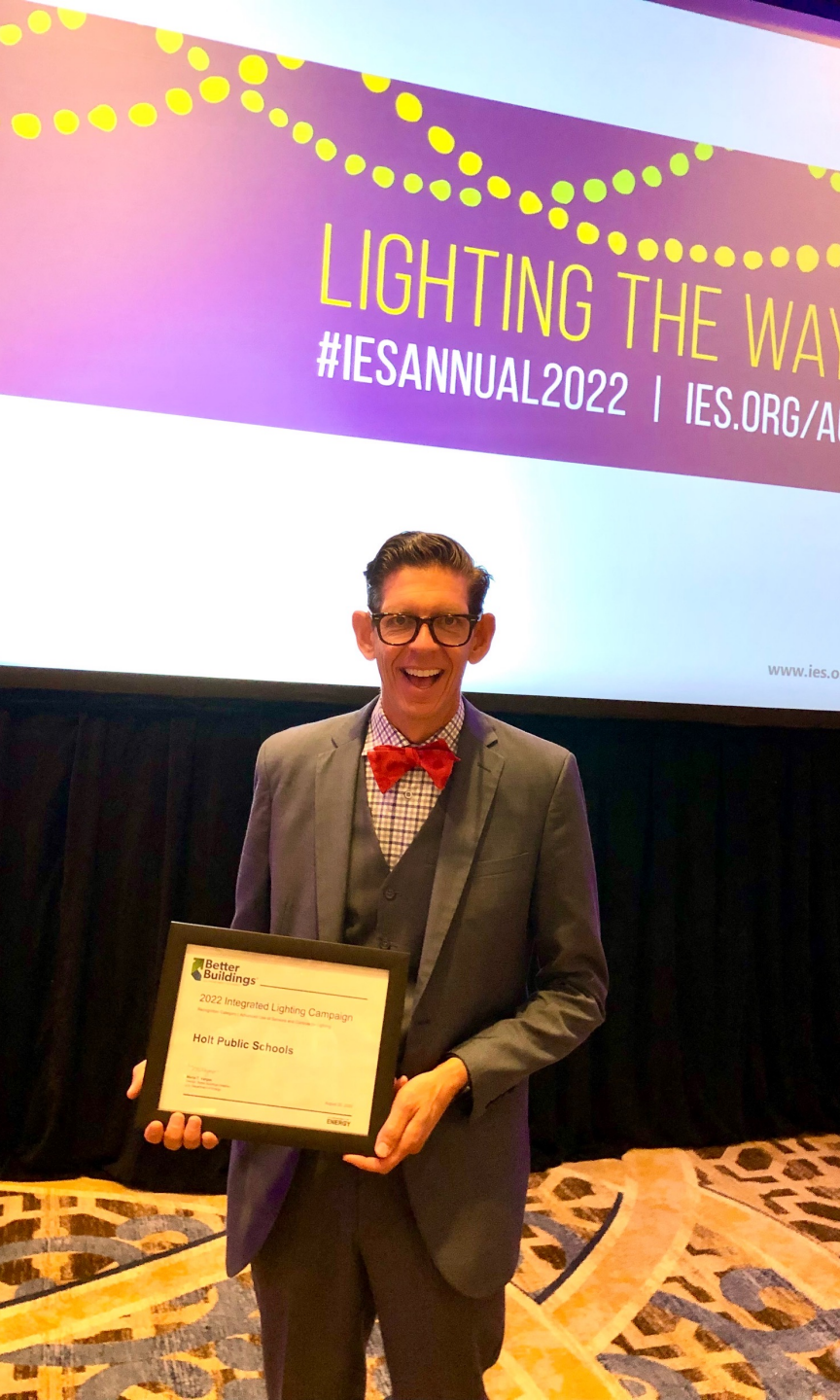
- Layers Control Strategies for higher Energy Savings

- High end Trim
- Vacancy Mode in Classrooms and Offices
- Daylighting?
- Dimming Controls for Teachers
- Energy monitoring for rebate qualification and M&V





Results



Results

Net Annual Savings 1.1million kWh

67% kWh reduction w/ LED retrofit alone

Additional 55% kWh reduction w/ Controls

School received an **additional \$200k+** with the addition of **NLCs**

ROI slightly over 3 years

Happy Teachers

National recognition for the school

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