Communicating the Network Lighting Control Value Proposition (NLC VP!)

Presented by

Armando Berdiel Chavez, LC, Meng.

Technical Development Supervisor

Spring 2021

lighting design lab

Before we begin...

During the Webinar

- Attendees will be muted
- Please use the chat feature in the control panel to submit questions to LDL staff
- The presenter will pause to address questions every ~10 minutes
- Please participate in the online polls.

Following the Webinar

- Please take the short survey
- A recording and the slide deck will be posted on LDL's webpage
- Reach out to LightingDesignLab@seattle.gov with comments or questions.

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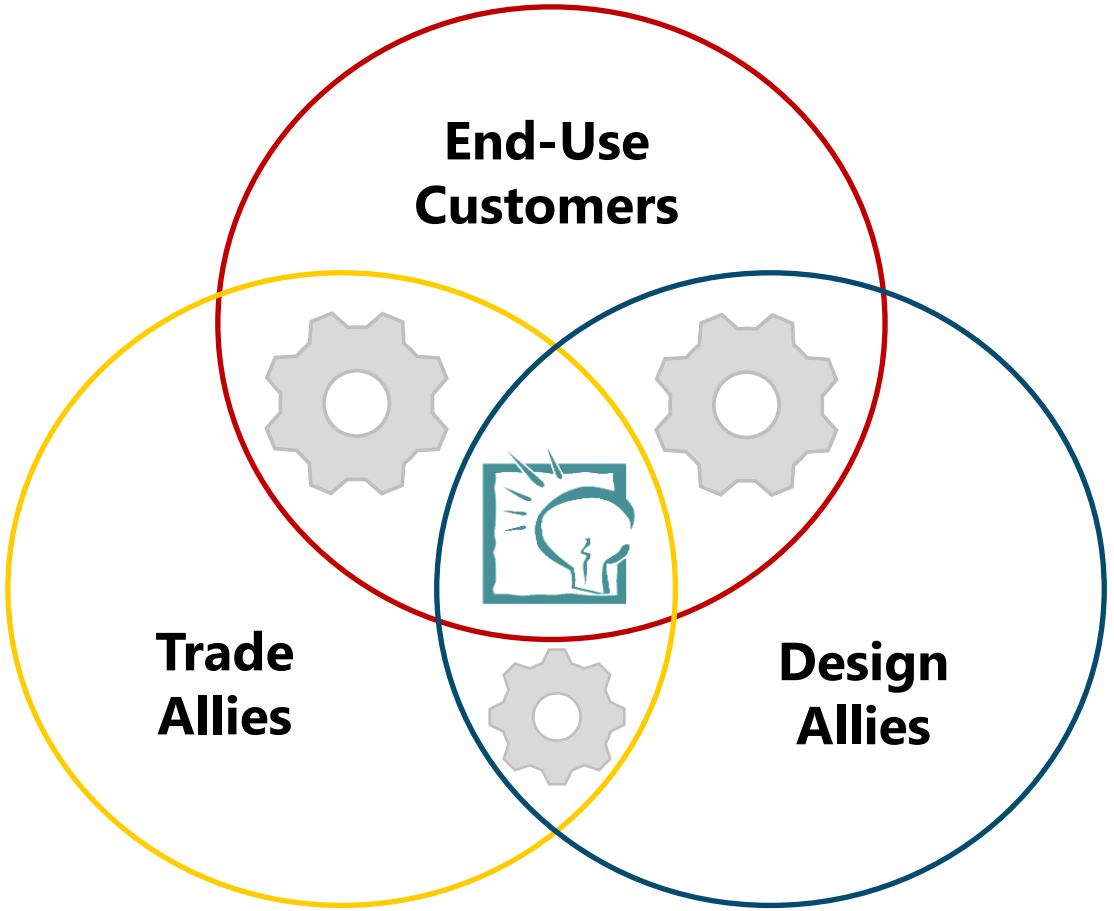
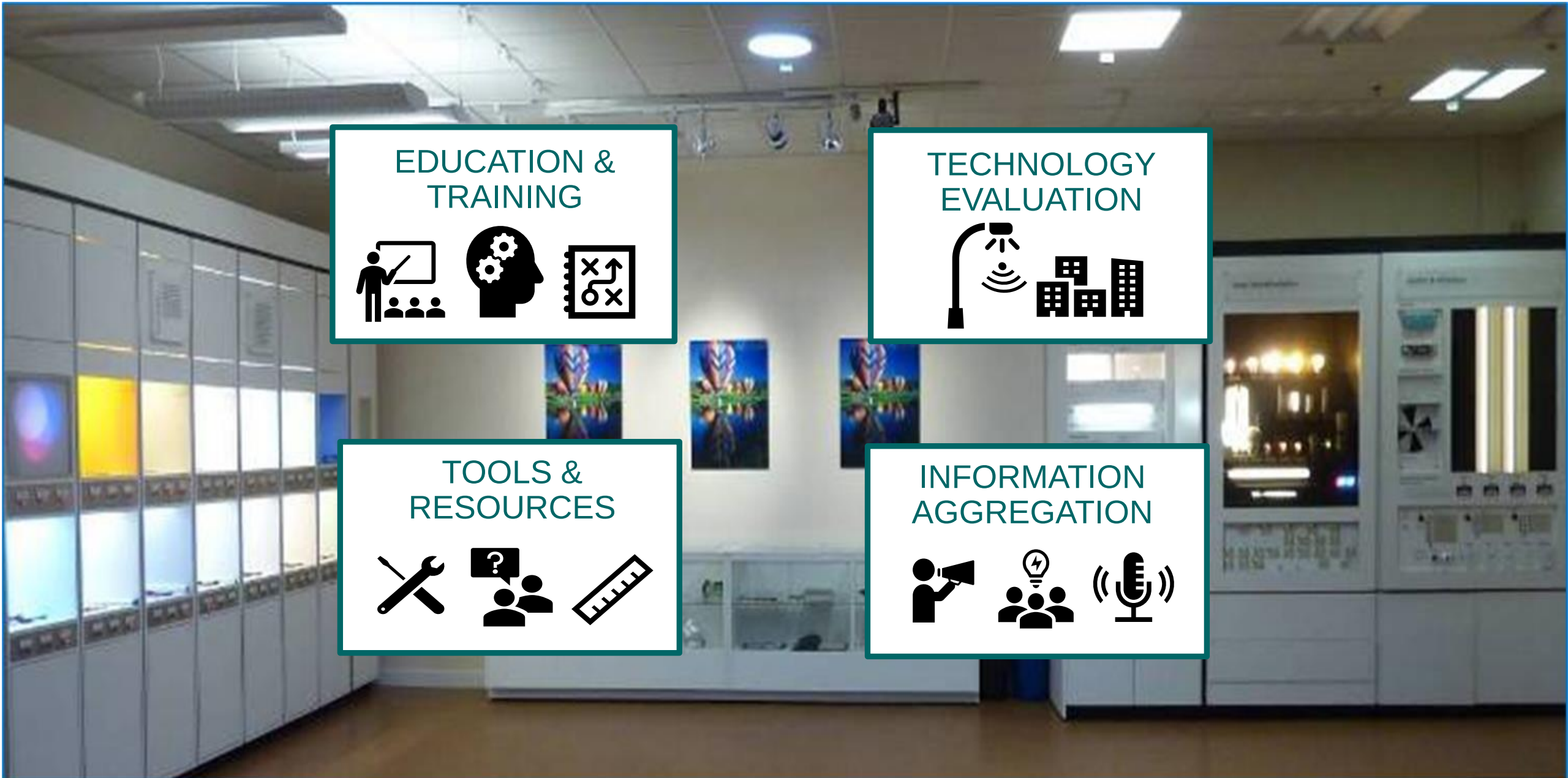
Who We Work With

It takes a village…



LDL's Four Core Service Areas



Instructor Background

Armando Berdiel Chavez, M.Eng., LC
Technical Development Supervisor

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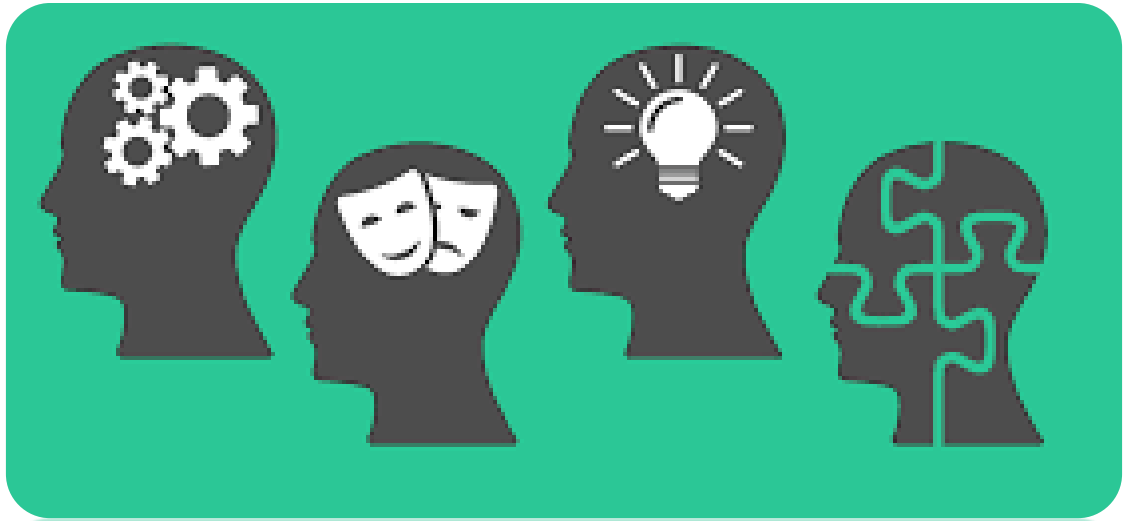
- Lehigh University, B.S.
  - Computer Science & Business
- Penn State University, Meng.
  - Engineering Management
- Lutron Electronics (PA)
  - Systems Support
  - Lead Project Coordinator
- Pearl Street LED Systems (NJ, NY)
  - Project Development Engineer

Time for a Quick Poll…

Enough about me…

Let’s talk about you…



Setting the Stage

NETWORKED LIGHTING CONTROLS SERIES

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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.

KEY DECISION MAKER

- **TENANTS** Living with the system
- **BUILDING OPERATORS** Leveraging the system
- **CONTRACTORS/ INSTALLERS** Implementing the system
- **OWNERS** Investing in the system

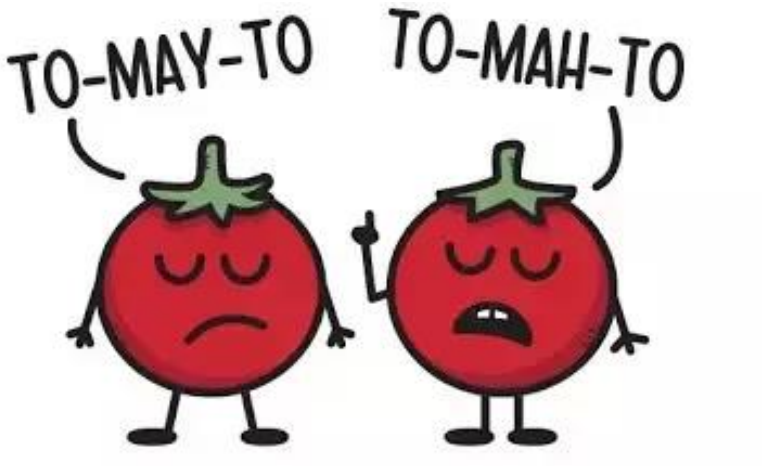
STEP 2: SIMPLIFY YOUR MESSAGE

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.

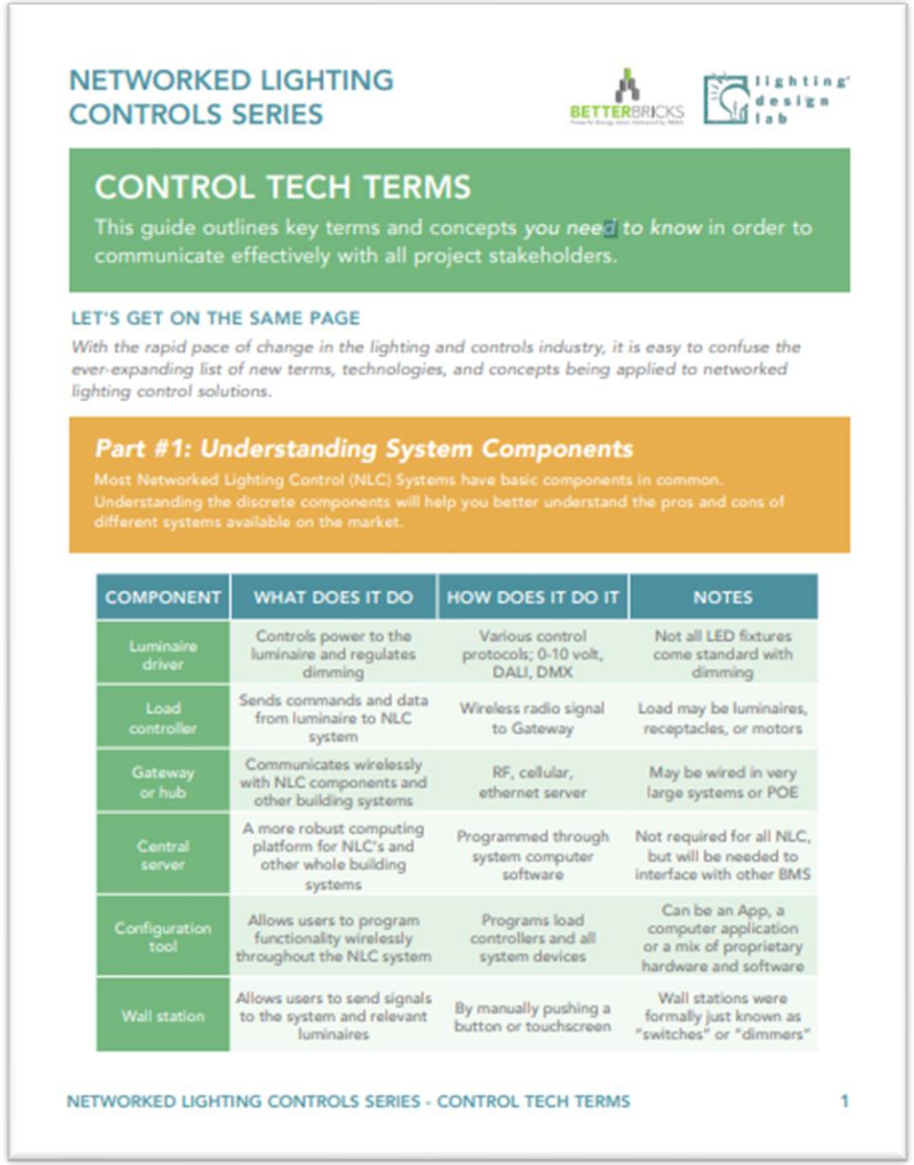
- **TENANTS** What does the user care about? What do we need to avoid?
- **BUILDING OPERATORS** What matters most to the building operators?
- **CONTRACTORS AND INSTALLERS** Where are the current contractor pain points?
- **BUILDING OWNERS** Which non-energy benefits matter most to this decision maker?

NETWORKED LIGHTING CONTROLS SERIES - COMMUNICATING THE VALUE PROPOSITION 1

Some Terms, Acronyms, Definitions



Term	Definition
NLC / ALC / LC	Networked Lighting Controls
LLLC	Luminaire Level Lighting Controls
Connected Lighting	LED + NLC
NEB	Non-Energy Benefits
SBE / SB	Smart Building Ecosystem



NETWORKED LIGHTING CONTROLS SERIES

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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"

NETWORKED LIGHTING CONTROLS SERIES - CONTROL TECH TERMS 1

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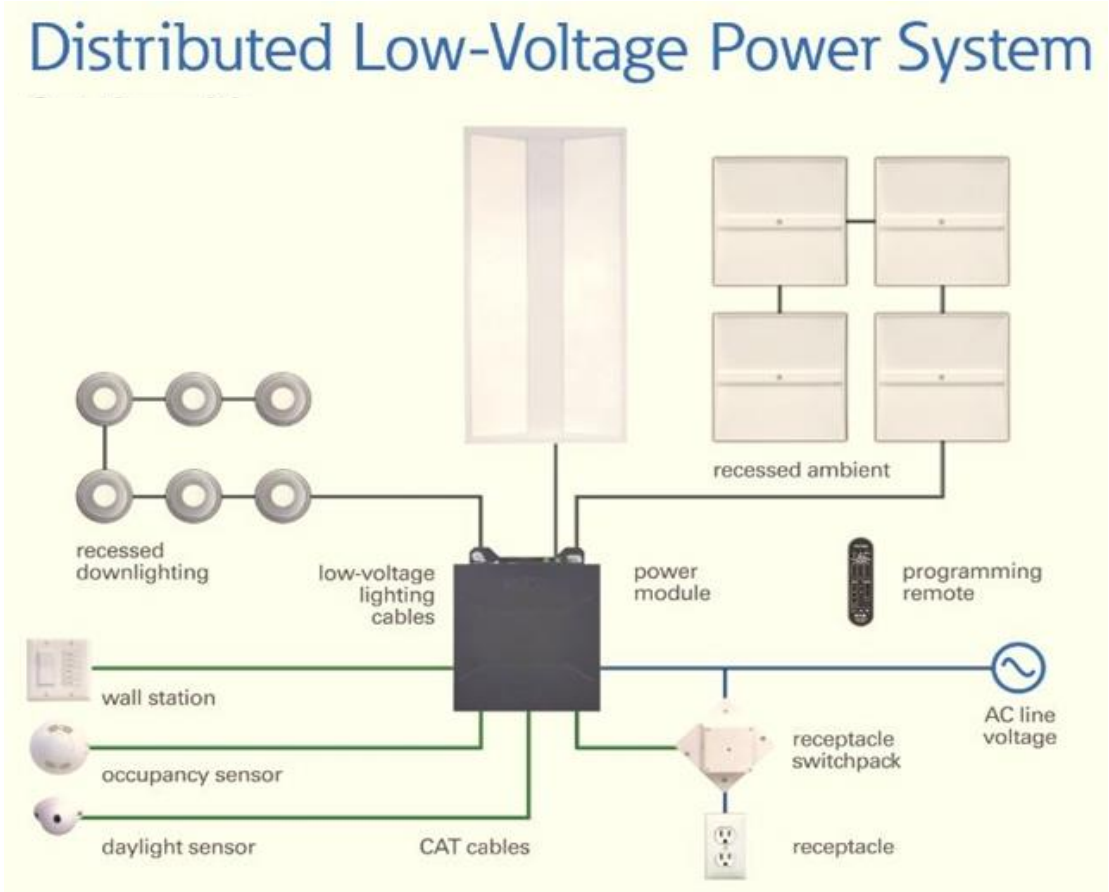
Distributed Lighting Controls vs. Networked Lighting Controls



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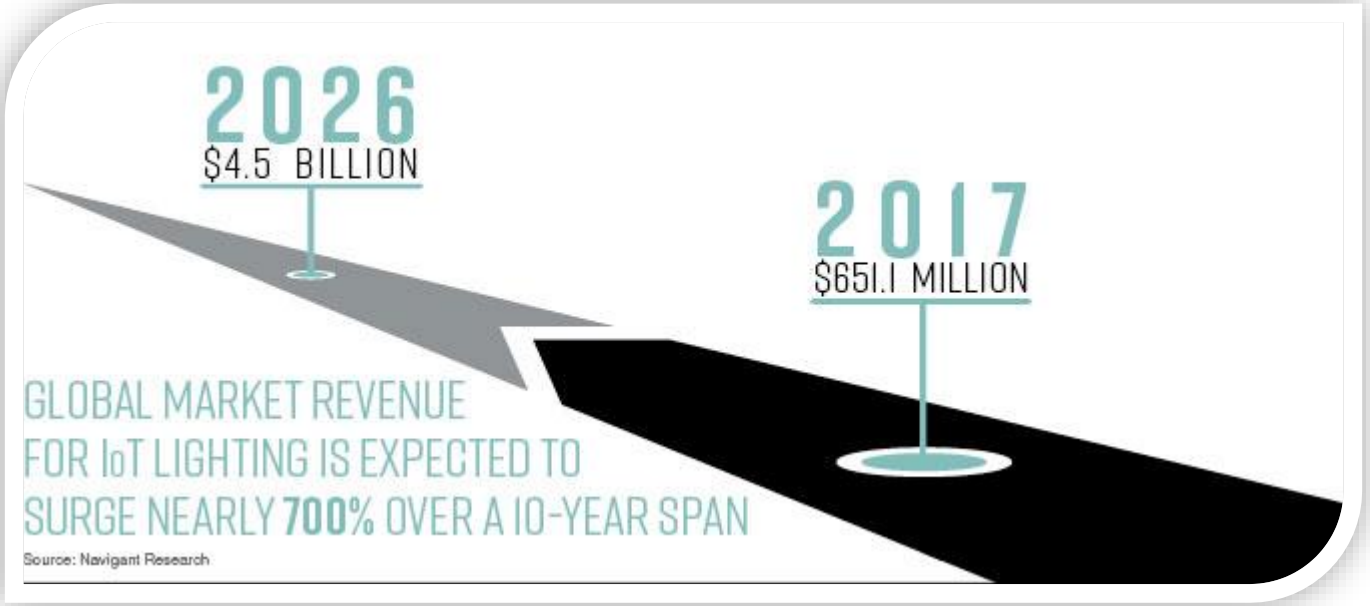
IES's LD+A: *Emerging Markets Report*

2020 Emerging Markets Report
Smart Lighting

"*Lighting can offer more* is the theme the industry is marching towards"

"The people that the lighting industry traditionally works with are not the people making decisions on the problems that IoT lighting solves."



- Michael Skurla, Gary Meshberg, Rick Schuett, Matt Ochs

Takeaways

- Interoperability among systems is critical
- Lighting customers will change
- Think beyond building operations to human-centric benefits

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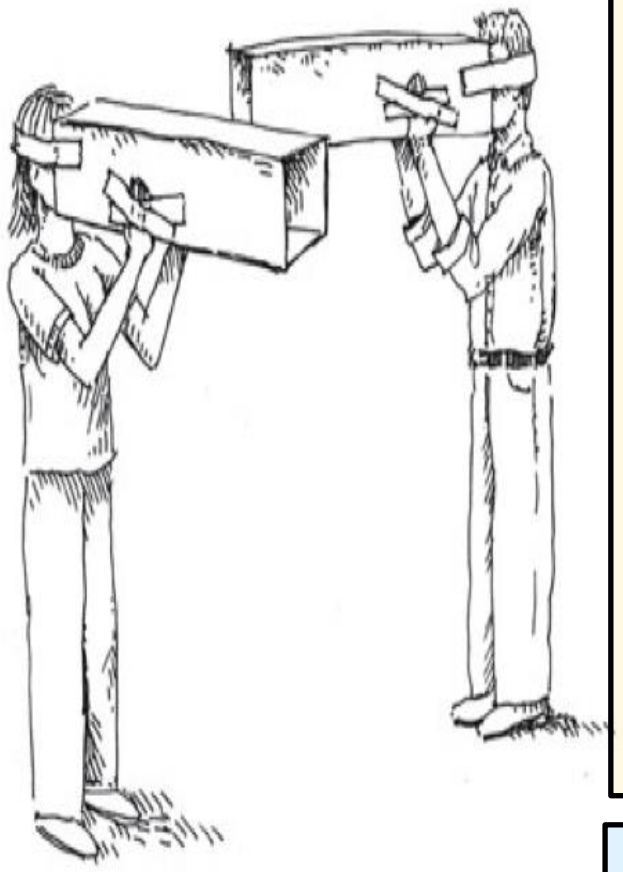
A Disconnect



We block out the voices trying to give us new information

Cost-Focused Stakeholder OR Implementer

Up front cost

Too complicated

Customer doesn't need it

Too time consuming

Design Ally:

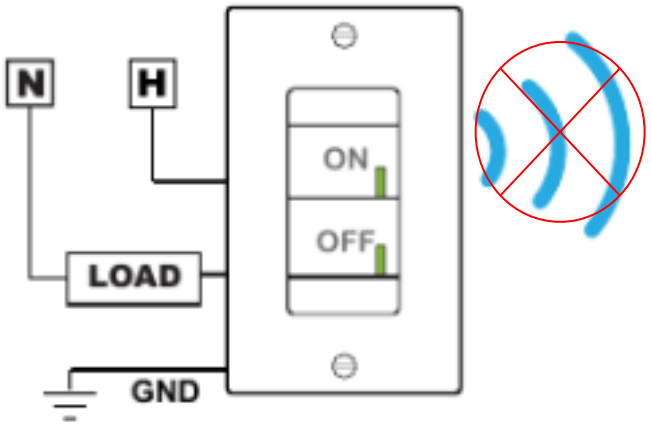
I can't remember the last time I didn't spec an NLC product…

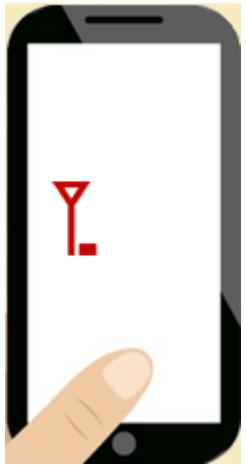
End-Use Customer:

I need integrated solutions…

The Odds Have Been Stacked Against NLC

Desired Timeout (Minutes)	Number of Flashes from Light/Motion Sensor
1 Minute	2 Flashes
5 Minutes	3 Flashes
15 Minutes	4 Flashes
30 Minutes	5 Flashes

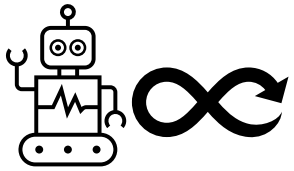




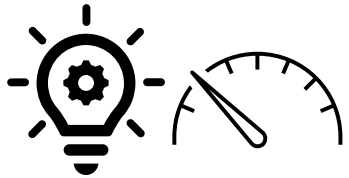
NLCs Today are Smoother and Leverage NEBs

Even though there is still a long way to go…

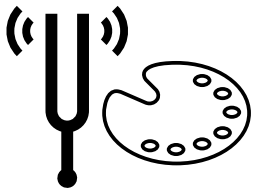
The Proliferation of *FEATURES*…



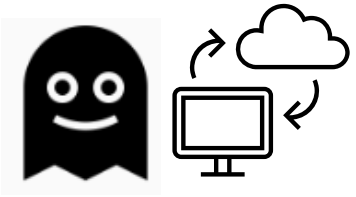
Controls Persistence



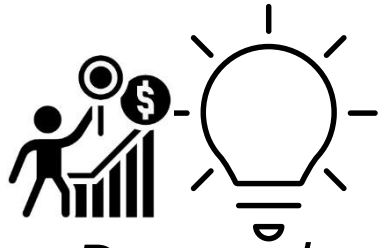
Energy monitoring



Color tuning



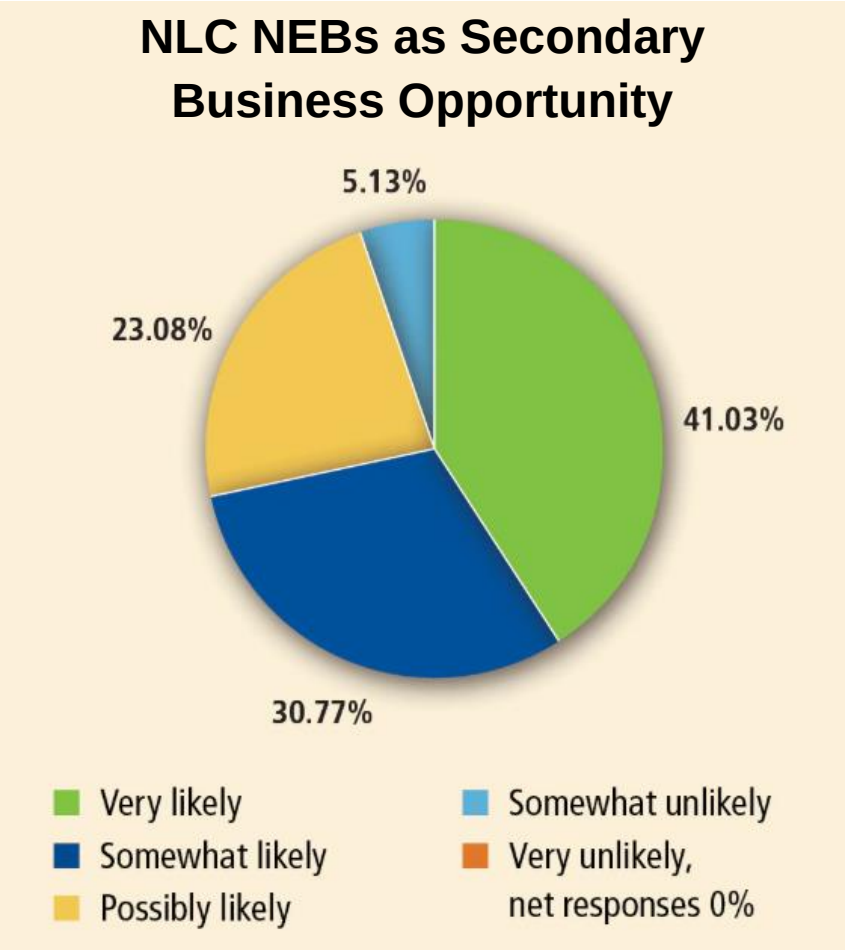
Cyber security



Demand Response

… and so many more

Connected Lighting Prospectus for Buildings



LEDs Magazine SSL "State of the Industry" 2020 Survey

The 1-9-90 Rule

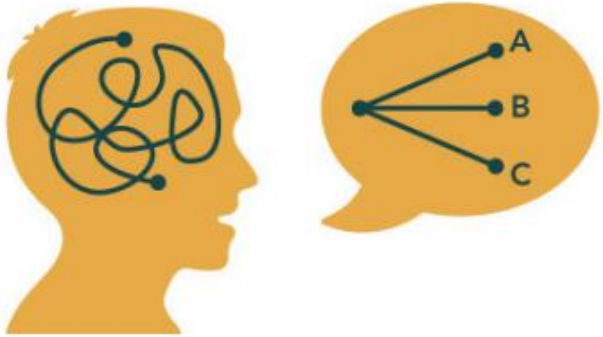
- 1% Energy & Resources
- 9%: Space & Layout
- 90%: Wellness & Productivity
- +100%: Revenue & Opportunities

Don’t Force the Horse

- A Solution Looking for a Problem?

- What are the most pressing problems/opportunities for your [Insert Building Type Here]?

It’s about the STAKEHOLDERS – not just the decision maker



Tenants

Living with the system

Facility Professionals

Leveraging the system

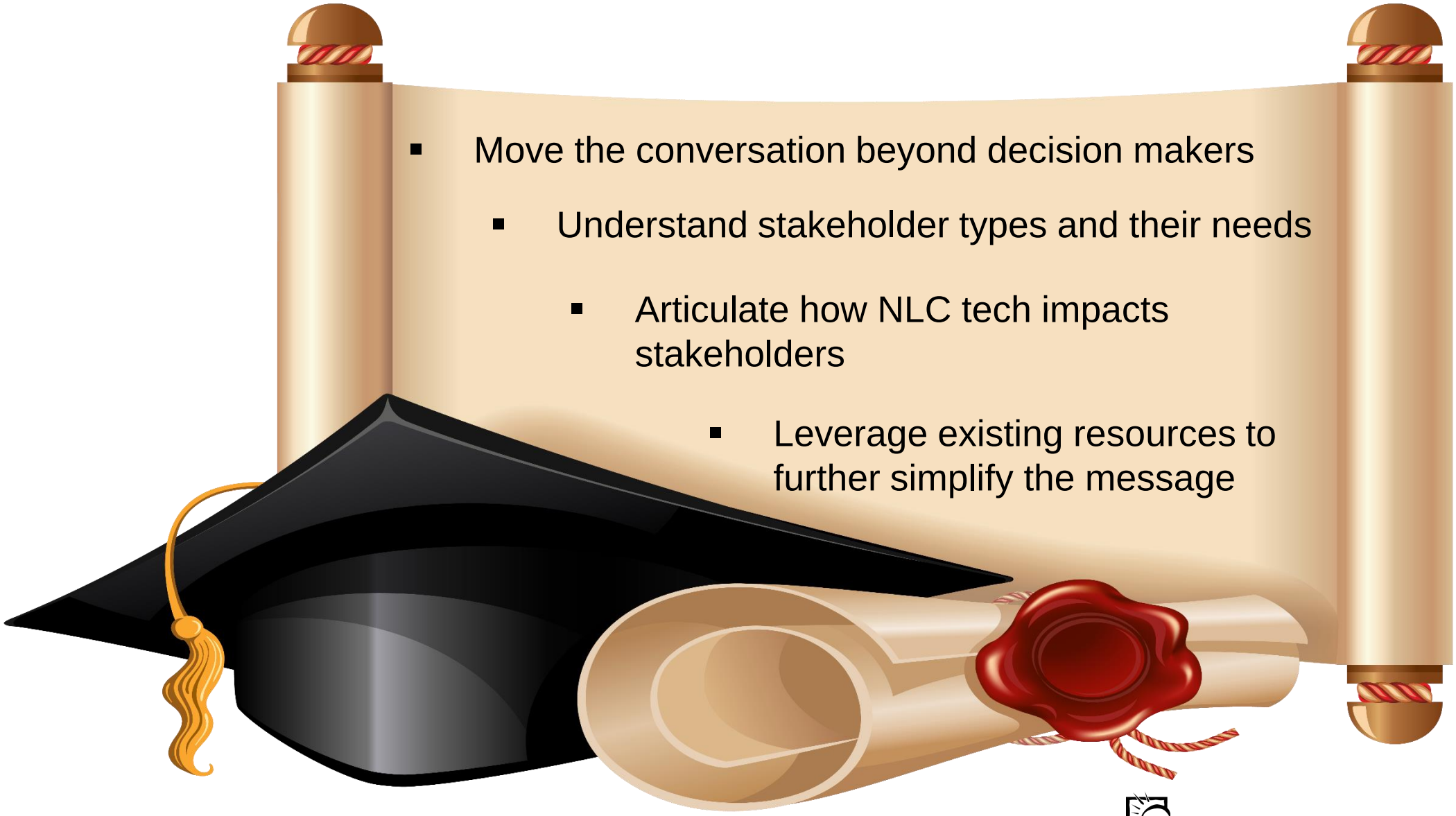
Implementers

Implementing the system

Owners

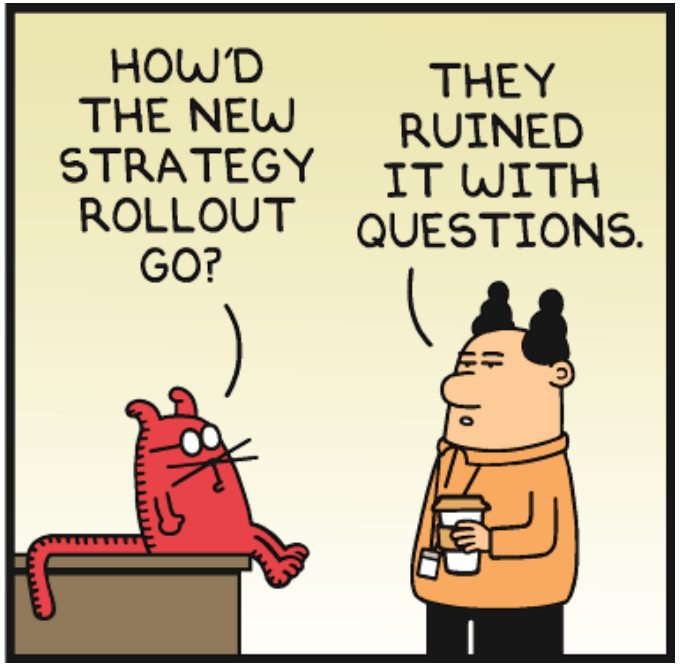
Invested in the system

Learning Objectives

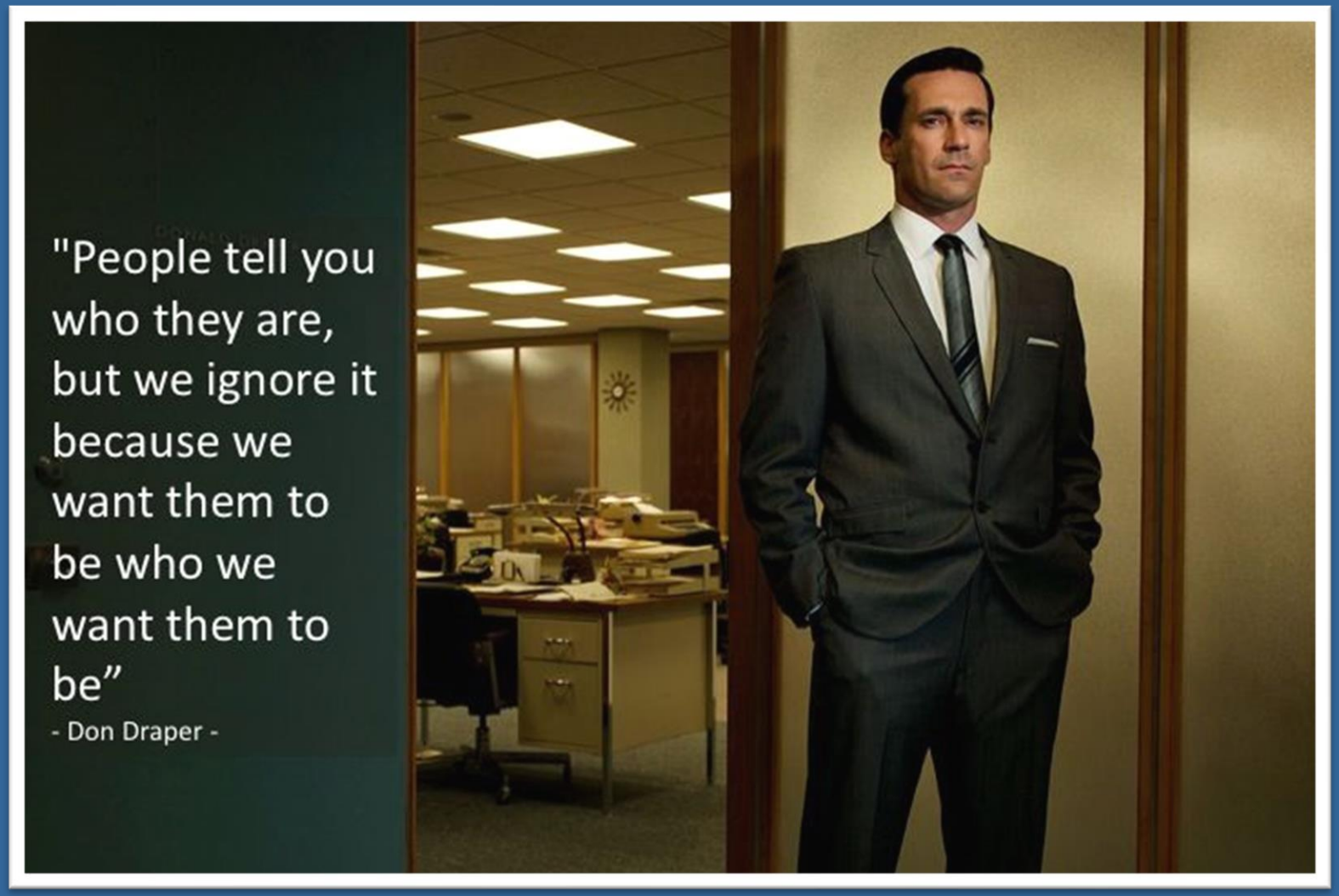


- Move the conversation beyond decision makers
  - Understand stakeholder types and their needs
    - Articulate how NLC tech impacts stakeholders
      - Leverage existing resources to further simplify the message

Pause for Questions



Identify the Stakeholders



IES's LD+A – Are You My Customer?

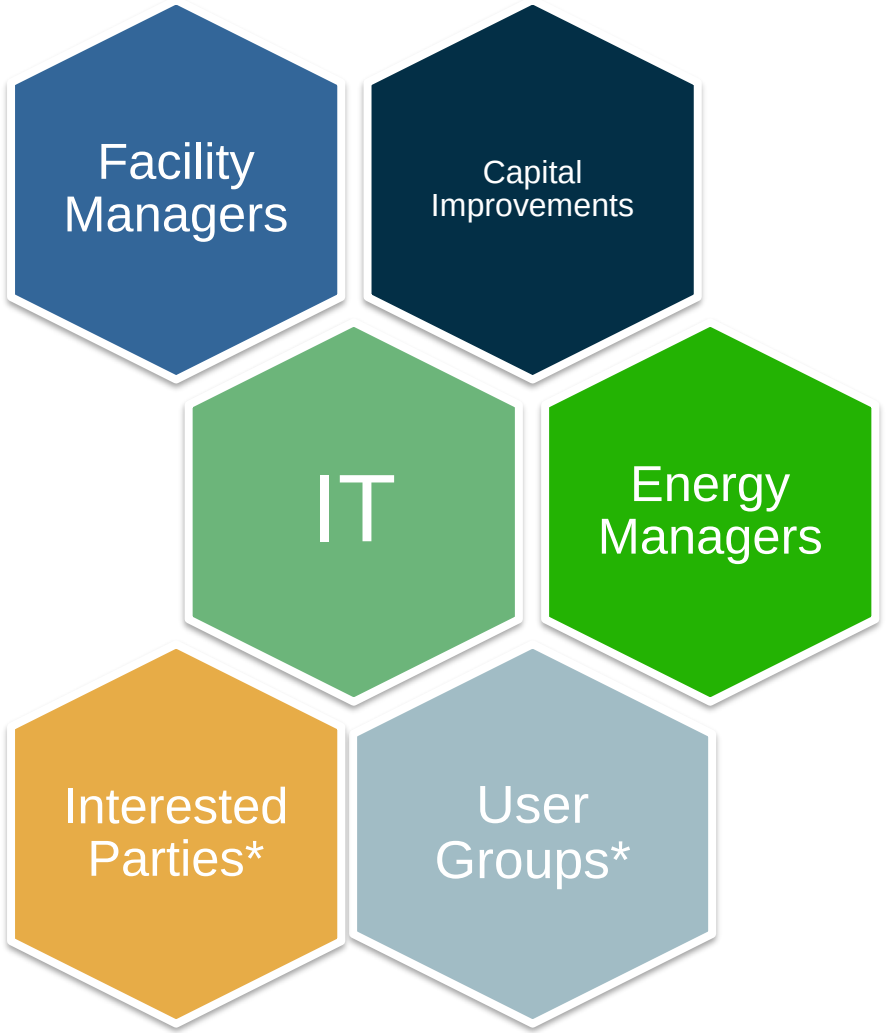
- Healthcare space considering NEB
- Stakeholders are not typical lighting decision makers

"Moving inside to a hospital—where the lighting can be used to keep track of where important assets like wheelchairs or equipment that must be recertified every six months is located, or where the temperature of every unit with refrigeration needs to be checked and temperatures logged three or four times a day, or where wayfinding apps can help a hospital achieve higher patient care satisfaction grades—do you know who to call on? The director of compliance, the VP of patient care and customer satisfaction, the inventory manager? Do you know how to find them, make an appointment and talk to them? Do you understand that they may not want to work together since money comes from different budgets, and that the director of facilities may not want you even talking to anyone else if lighting is involved because she sees their involvement as an intrusion into her turf? How do you work through all of these new "opportunities?"

- Rick Schuett

Decision Makers vs. Stakeholders

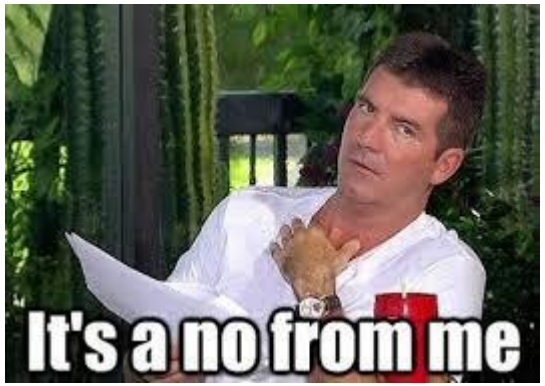
- Recommenders, Influencers, Gatekeepers
- They send key info upstream
- Understand level of involvement
- Get Buy In ***EARLY***



Lunera Smart TLEDs Pilot at NYU

- 2017 Pilot at NYU
- Free gear from Lunera
  - Happy decision makers
- Each T8 needed IP address on Client's Network

IT Dept:



Lunera Lighting

Tenants and Their Needs

- 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 their environment

Tenants

Living with the system

Facility Professionals and Their Needs

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

Facility Professionals

Leveraging the system

Implementers (Design & Trade Allies) and Their Needs

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

Contractors / Installers

Implementing the system

Building Owners and Their Needs

- Flexibility for future space changes
- Meet code, certification, inventive requirements
- Reduce operating costs, increase revenue opportunities
- Future-proofing the building with tomorrow's NLC features

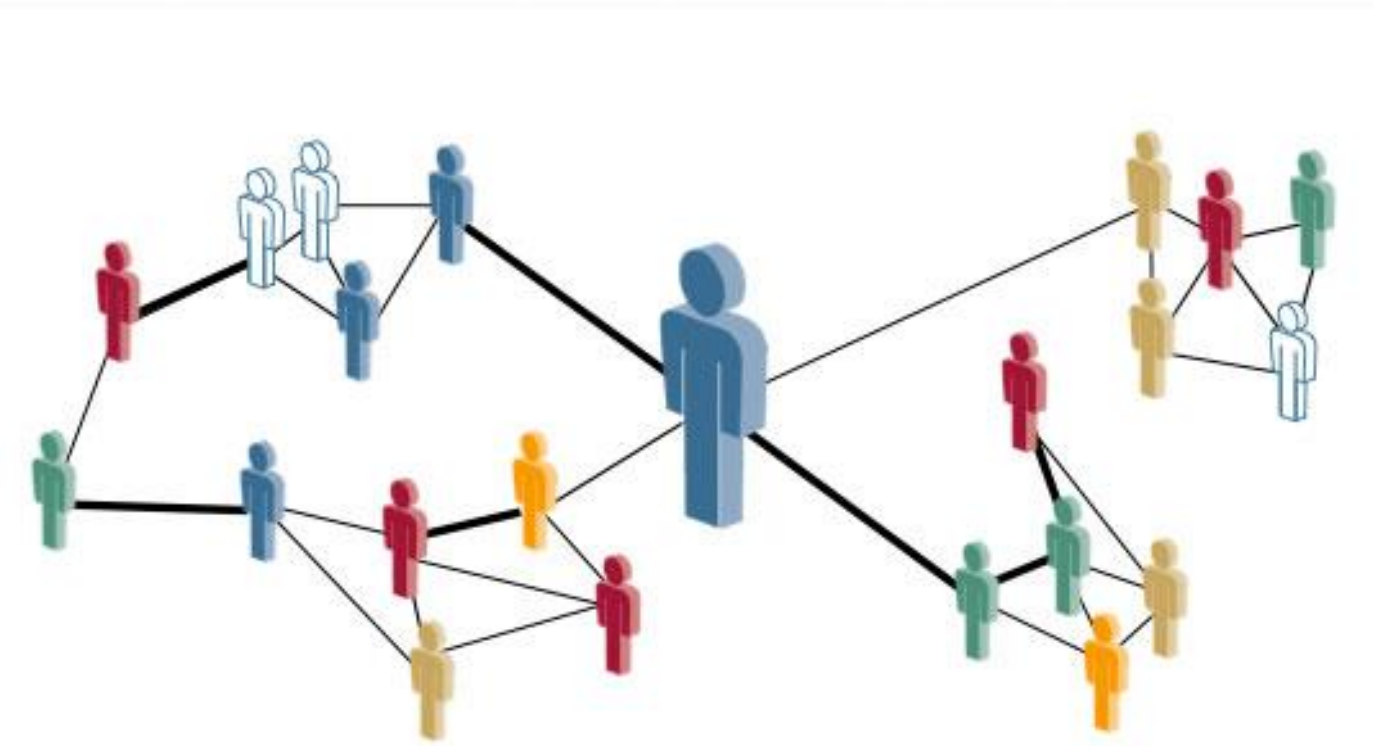
Owners

Invested in the system

Map Out Decision Makers and Tiered Stakeholders

- Appropriate Topics to the Appropriate Stakeholder

- Create map of tasks and influencers.



Tie-in with Stakeholder's Purpose & Goals

Seattle Department of Construction & Inspections

Foster Relationships Through Education, Awareness, and Continuous Improvement

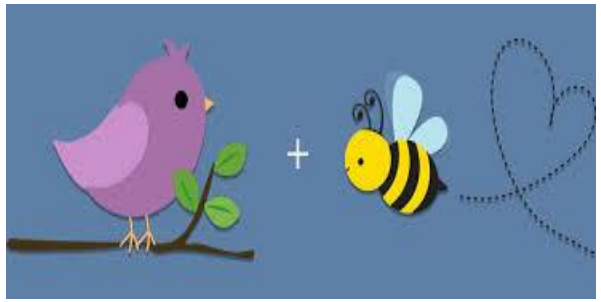
Pause for Questions

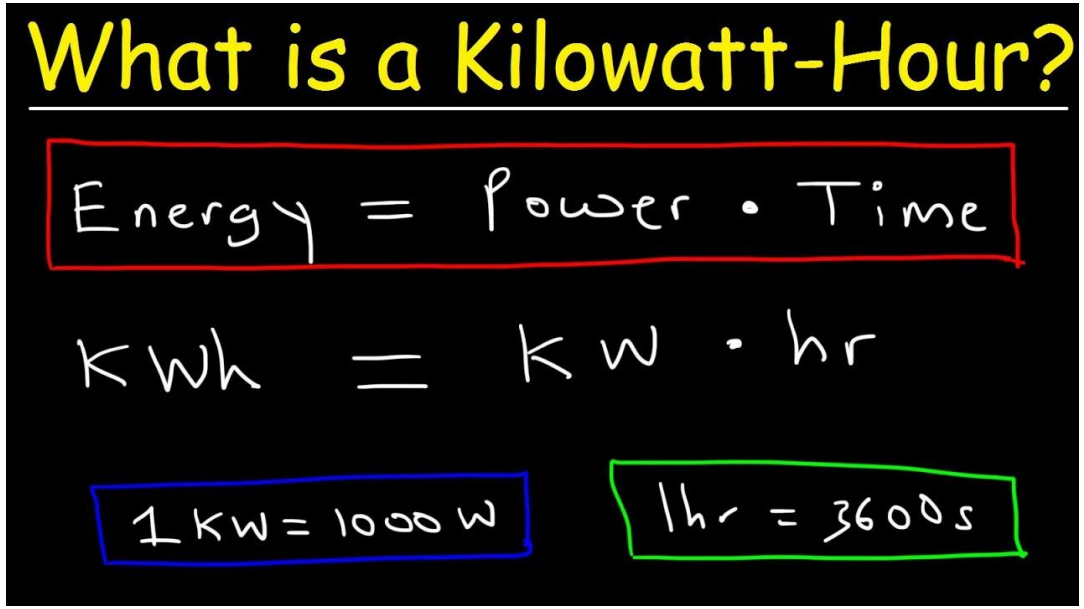
Poll: Select all that are true for you

Review on Savings and Traditional NLC Strategies

Where do Savings Come From?

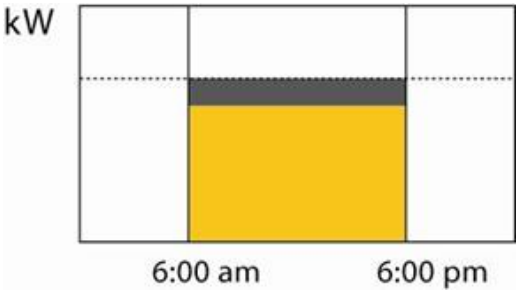
- Converting to LEDs
- Adding NLC/LLLC Systems
- Whole Building System Management



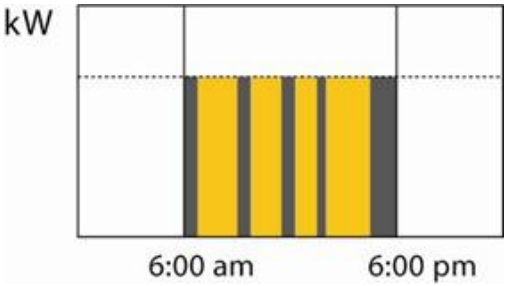


Four Key Control Strategies – Crash Course

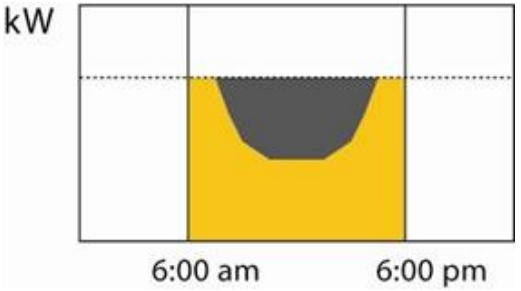
High End Trim or Task Tuning



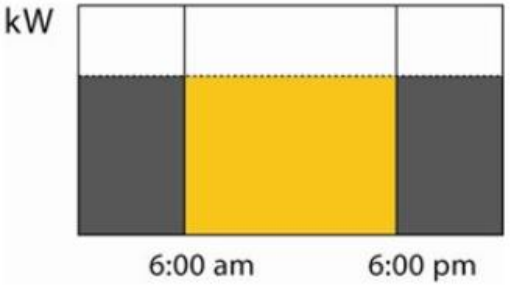
Occupancy & Vacancy



Daylight Harvesting

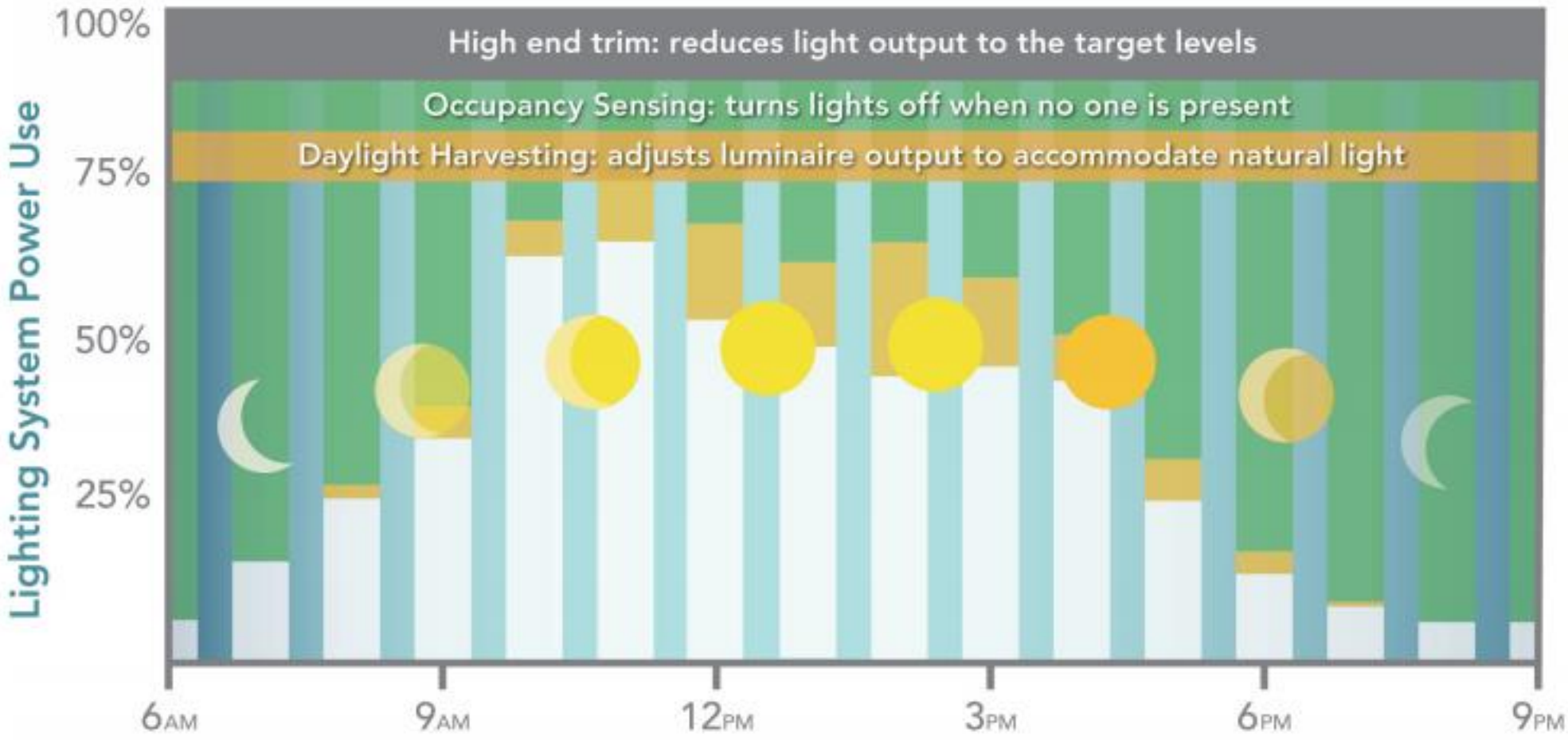


Scheduling

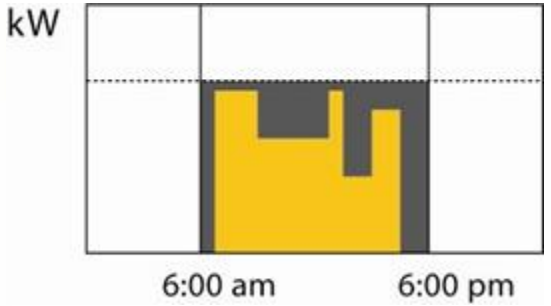


How These Control Methods Work Together

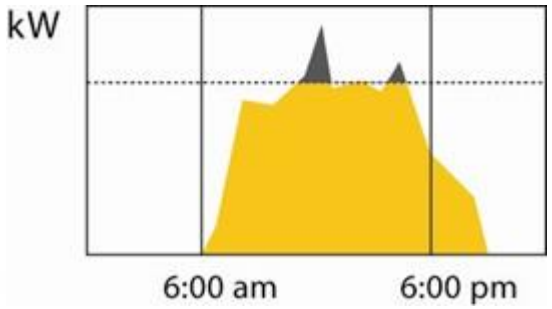
At the building level



Personal Control



Demand Response



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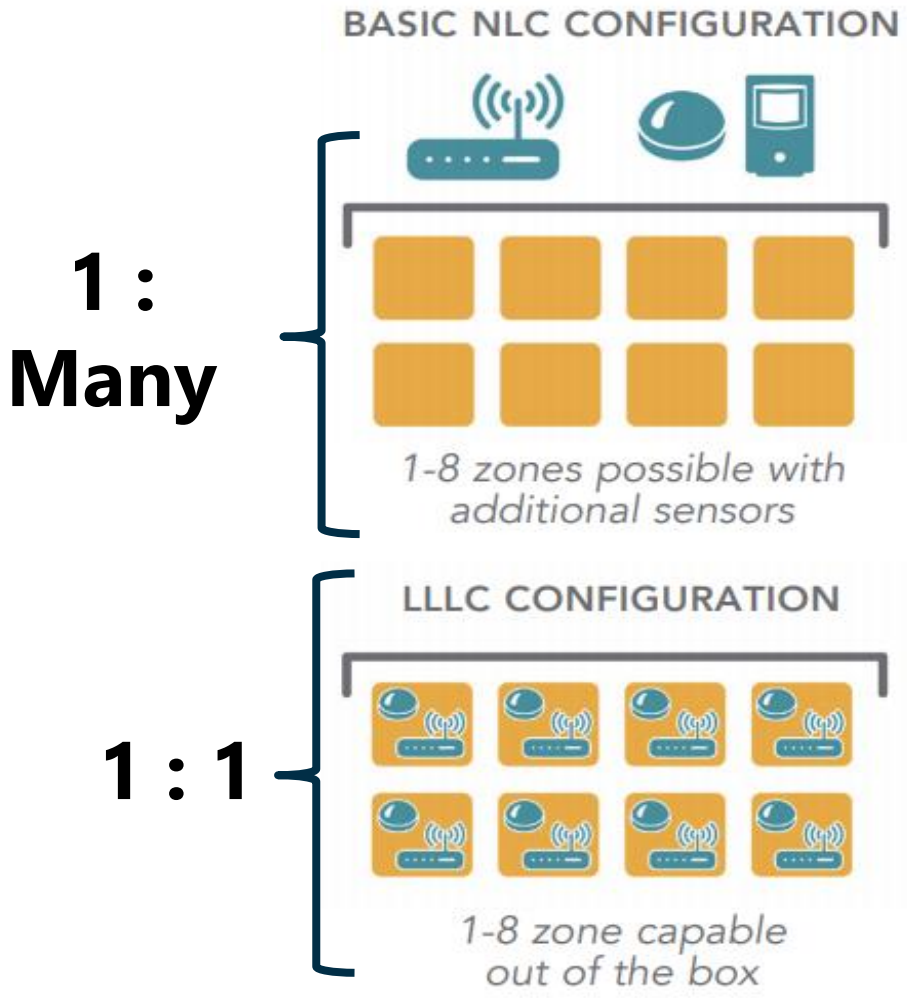
Did You Know… NLC & LLLC

- Luminaire Level Lighting Control
  - Individually Addressable
  - Integrated occupancy and daylight sensors
  - Continuous dimming
  - Networkable
- Benefits
  - Less Components
  - Labor Savings
  - Simple Configuration
  - Future Expandability
  - Reconfigurable



BONUS: Automatically Meets Code

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LLLC in Seattle/Washington 2018 Energy Code

- LLLC in open office >5000 sqft
  - Or NLC with Individual Addressability
- LLLC for control in all areas
  - Or NLC following code requirements
  - Including Daylight commissioning

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with ((~~one~~)) item 1 or item 2 of the following:

1. Lighting controls as specified in Sections C405.2.1 through C405.2.7. In addition, any contiguous open office area larger than 5,000 square feet shall have its general lighting controlled by either:
   1.1. An enhanced digital lighting control system conforming to the requirements of Section C406.4; or
   1.2. Luminaire-level lighting controls (LLLC) conforming to the requirements in Item 2 of this subsection.
2. *Luminaire level lighting controls (LLLC)* for all areas and lighting controls as specified in Sections C405.2.1, C405.2.3 and C405.2.5. The *LLLC luminaires* shall be independently configured to:
   2.1. Monitor occupant activity to brighten or dim lighting when occupied or unoccupied, respectively.
   2.2. Monitor ambient light, both electric and daylight, and brighten or dim artificial light to maintain desired light level. A maximum of 8 fixtures are permitted to be controlled together to maintain uniform light levels within a single *daylight zone.*
   2.3. For each control strategy, be capable of configuration and re-configuration of performance parameters including: bright and dim set points, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configuration.

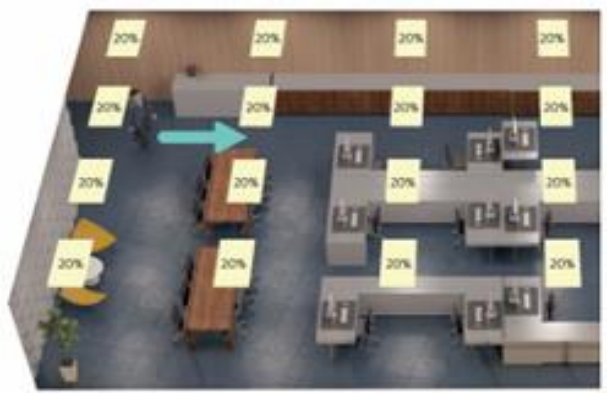
How These LLL Control Methods Work Together

At the room level – Open Office

7:00am

Initial walk-in

Lights on to background or daylight level



9:00am

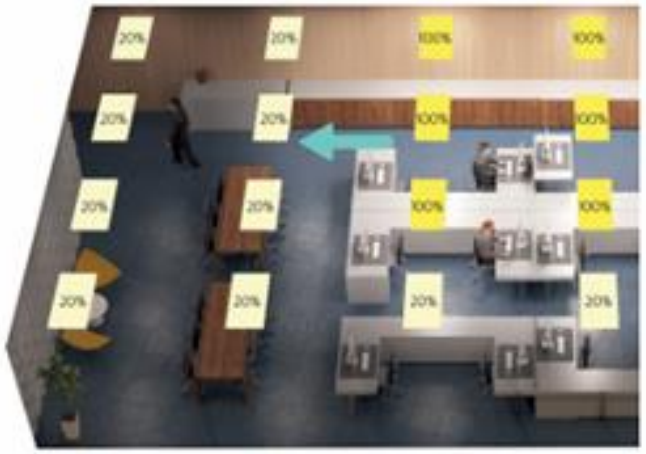
Half Occupied

Lights brighter on occupied desks, not on vacant spaces

5:00pm

Leaving

Lights go to set level as people leave, brighter if occupied



7:00pm

Vacant Space

Lights go off

Images Courtesy of Signify

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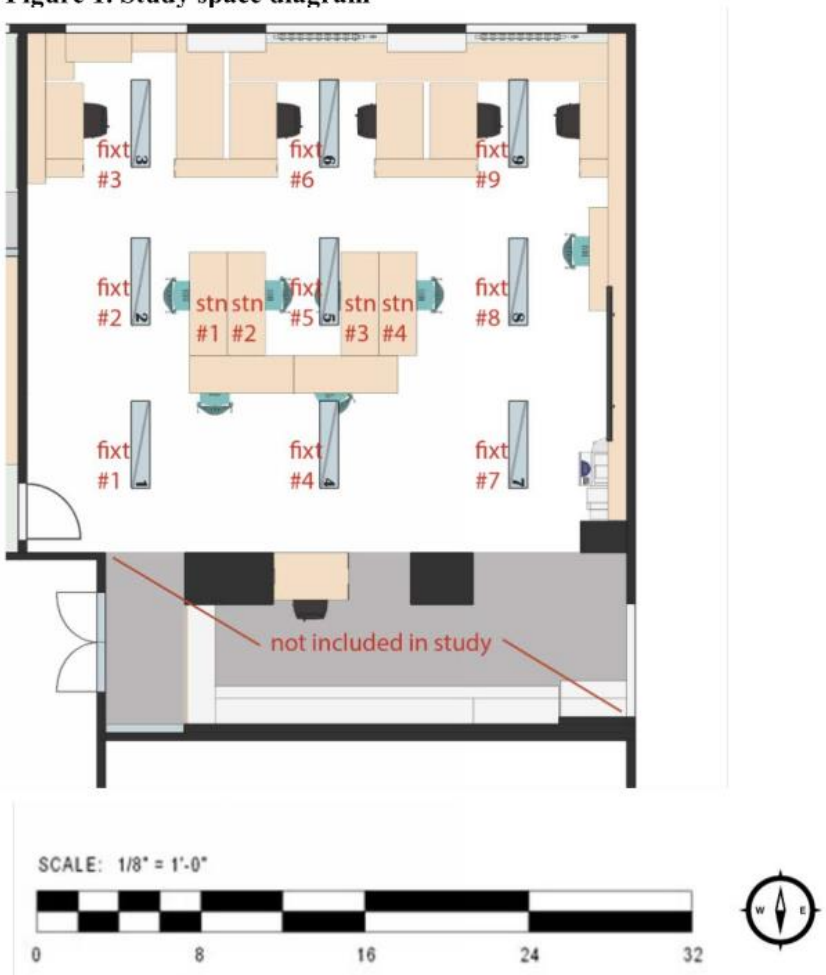
NEEA NLC/LLLC Retrofit Study

Luminaire Level Lighting Controls Replacement vs Redesign Comparison Study

September 3, 2020

REPORT #E20-315

Figure 1. Study space diagram



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LLLC/NLC Retrofit Systems Cost Comparison

Table 12. Total Cost Comparison of All Retrofit Solutions

System	*Hardware total*	*Luminaire per unit*	*Labor*	*Design/ Specification*	*Total cost*	*Total cost/ft²*
LLLC System #1	$4,181.00	$380.00	$1,045.00	$252.76	**$5,383.76**	**$6.04**
LLLC System #2	$4,204.77	$410.00	$1,536.15	$379.14	**$6,120.06**	**$6.87**
LLLC System #3	$4,455.43	$490.00	$1,163.75	$1,011.04	**$6,630.22**	**$7.44**
LLLC System #4	$4,015.96	$403.00	$760.00	$631.90	**$5,407.86**	**$6.07**
Redesign System #5	$8,347.07	$389.00	$1,654.90	$5,655.80	**$15,657.77**	**$17.57**

LLLC/NLC Retrofit Systems Implementation Times

Table 3. Time Required for Install, Programming, and Commissioning

System	*Hardware install (HH:MM)*	*Programming (HH:MM)*	*Commissioning (HH:MM)*	*Total (HH:MM)*
LLLC System #1	05:15	00:45	03:00	**09:00**
LLLC System #2	05:50	02:45	04:30	**13:05**
LLLC System #3	05:40	00:35	04:30	**10:45**
LLLC System #4	03:30	00:30	02:30	**06:30**
Redesign System #5	07:05	02:35	06:00	**15:40**

Annual Estimated Savings & by Major Strategies

System	Fixture Zone *	Annual estimated lighting energy savings based on pre-tuning maximum energy consumption					
		Savings due to all controls measures		Savings due to daylight and occupancy		Savings due to high-end trim	
LLLC System #1	Perimeter	74%	51%	74%	45%	0%	6%
	Middle	49%		37%		12%	
	Core	32%		25%		7%	
LLLC System #2	Perimeter	85%	74%	75%	40%	10%	34%
	Middle	74%		23%		51%	
	Core	71%		31%		40%	
LLLC System #3	Perimeter	80%	50%	80%	42%	0%	8%
	Middle	45%		31%		13%	
	Core	25%		15%		10%	
LLLC System #4	Perimeter	86%	63%	71%	43%	15%	20%
	Middle	58%		35%		23%	
	Core	47%		26%		21%	
Redesign System #5	Perimeter	86%	67%	71%	32%	15%	35%
	Middle	73%		23%		50%	
	Core	47%		7%		40%	

Notes: Annual estimated lighting energy savings attributed to controls relative to pre-tuning maximum energy consumption of each fixture and system.

Never Forget… The Human Factor

4.5 Human factors comfort responses

- Highest satisfaction: LLLC systems being tuned to IES standards
- Overall brightness was found to be lower than expected (Trim)
- Light was more calming and helped focus than FL baseline
- Brighter task (desk) illuminance
- No major satisfaction difference between LLLC & NLC

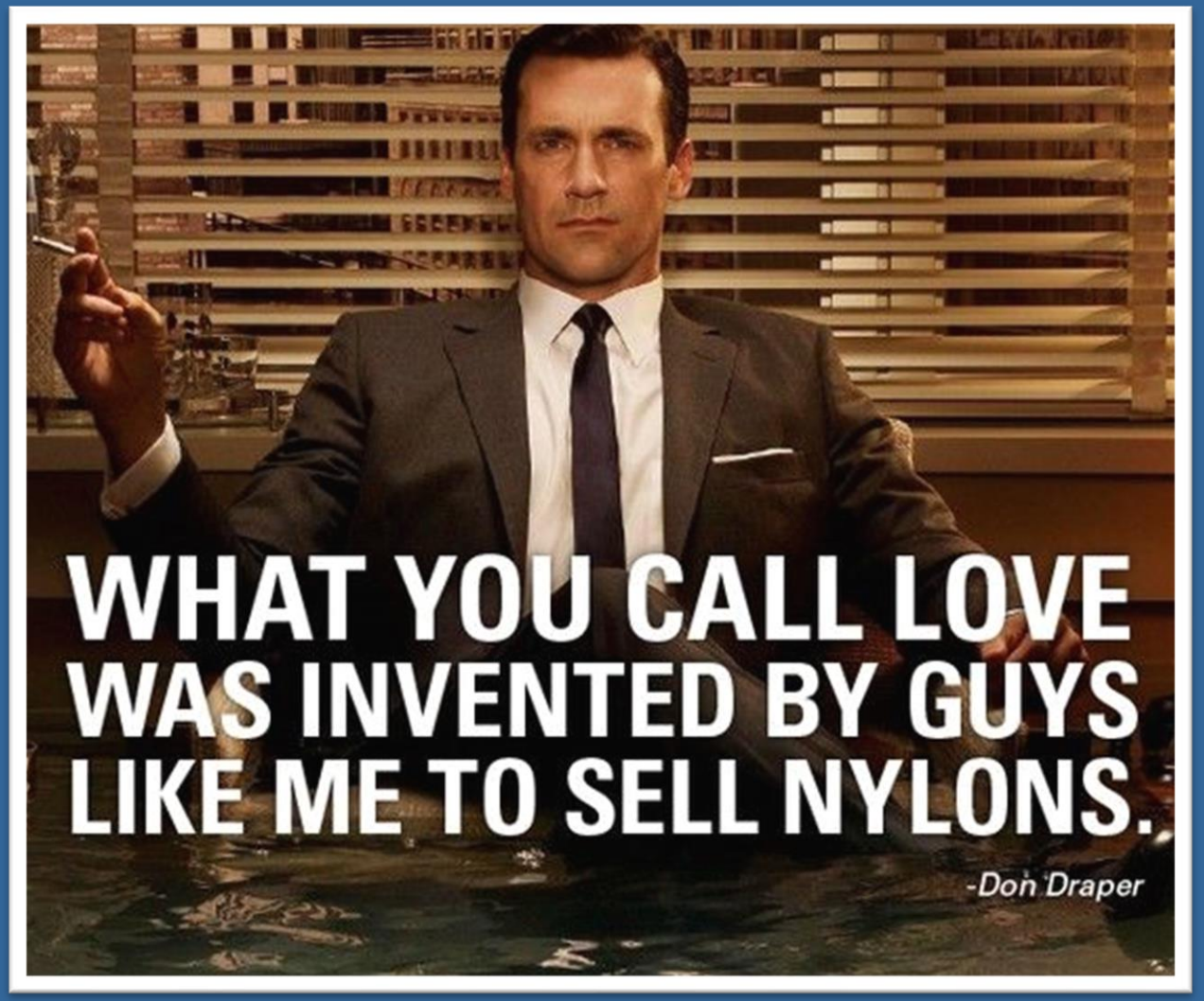
Table 8. Study Participant Demographics and Sample Statistics

	Total # subjects	*Female/ male*	*Age*			*Vision correction*	*Total # 2-hr session*
			18-30	*31-45*	*46-55*	*Y/N*	
Baseline	8	4/4	7	0	1	5/3	22
LLLC System #1	16	8/8	13	3	0	6/10	34
LLLC System #2	12	7/5	8	4	0	5/7	28
LLLC System #3	10	7/3	7	3	0	4/6	34
LLLC System #4	15	8/7	11	3	1	6/9	36
Redesign System #5	15	9/6	14	0	1	4/11	29
Total	**76**	**43/33**	**60**	**13**	**3**	**30/46**	**183**

Poll: What is your experience with LLLC Technology?

Pause for Questions

Value Proposition Examples of Non-Energy Benefits



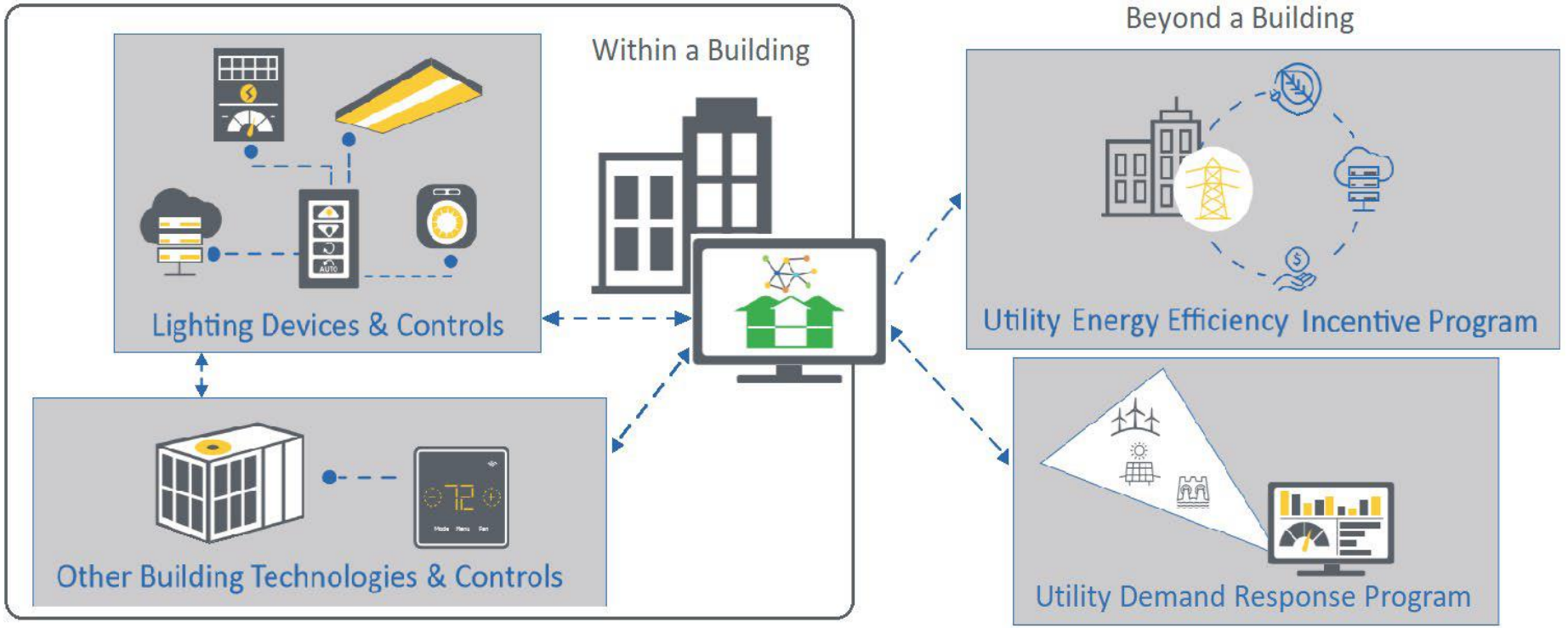
What is Interoperability?

From ANSI C137.0-2017

The ability of systems or system components to transmit, receive, interpret, and/or react to data and/or power and function in a defined manner.

Three primary types of Interoperability

- Device to Device
- Device to System
- System to System



Smart Building Platforms are Increasing and Evolving

Facility Professionals

Owners

Tenants

Implementers

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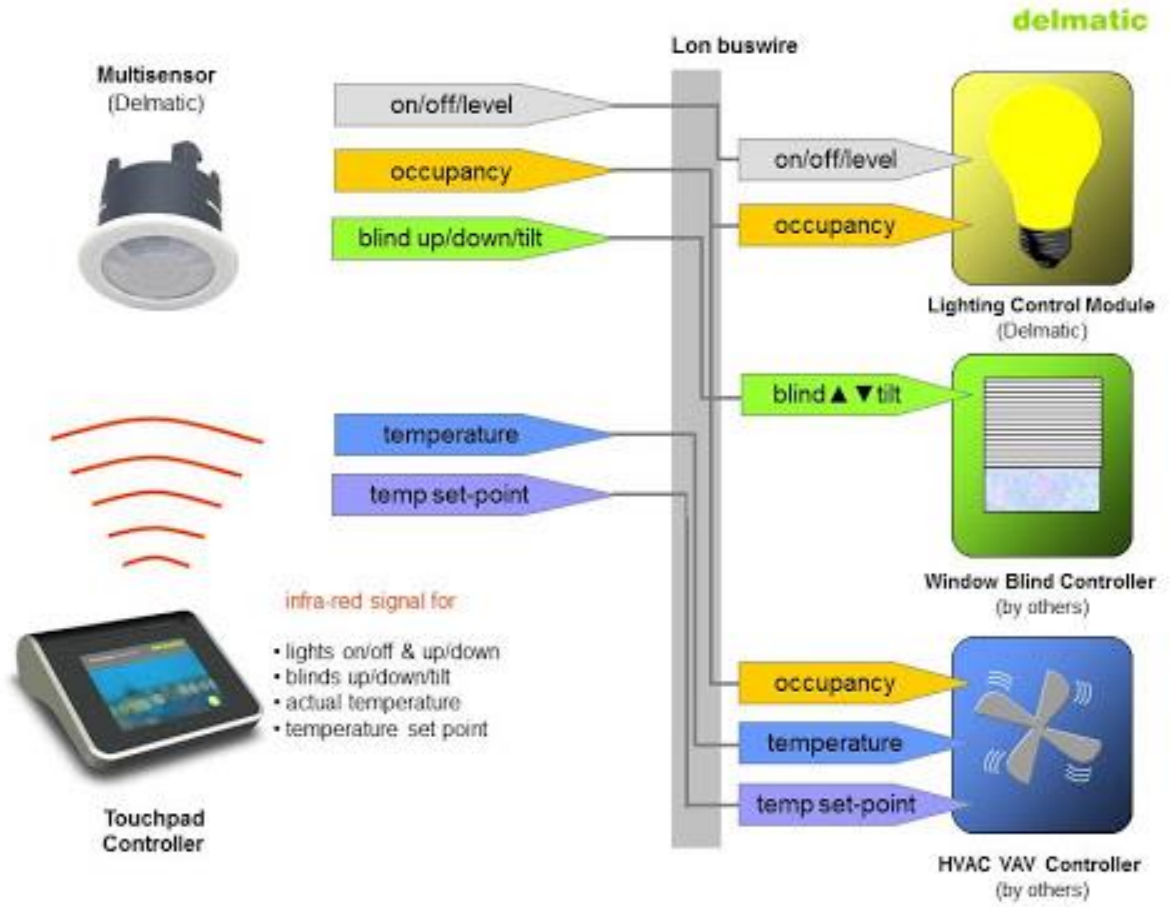
NLC & HVAC System Interoperability Example

- Analog or Digital integration
  - Contact closure / relay
  - API & BMS
- HVAC Zone Level: Ventilation rate & thermostat reset
- Optimize BMS through granular data
- Optimize energy savings without jeopardizing occupant thermal comfort

Image by Delmatic



NLC/LLLC Energy Monitoring, Control, & Diagnostics

- System interface dashboarding
- Exporting data
  - CSV
  - Cloud-based connection
  - API
- Standards are being worked on
- Measurement
  - Calculated
  - Measure current drawn

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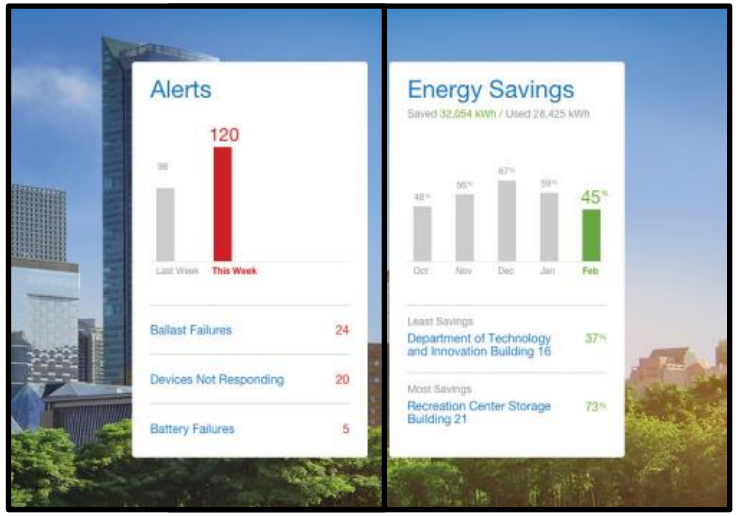
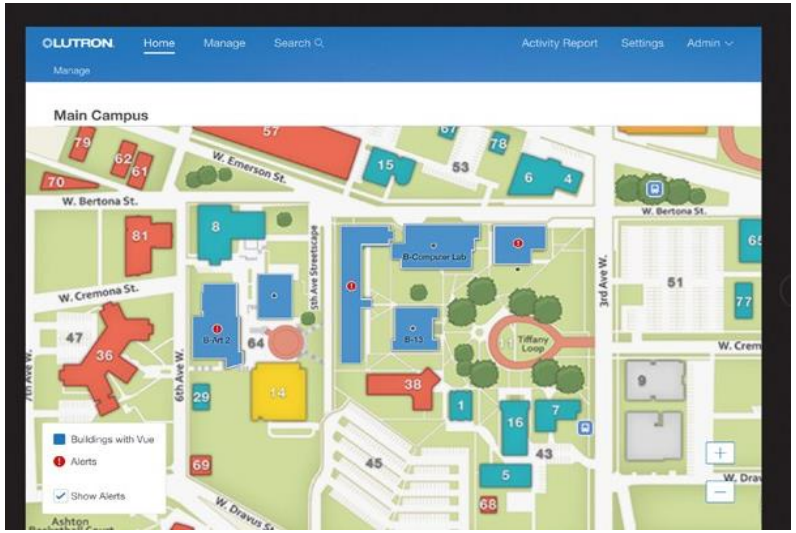
Lutron Vive





Lutron Enterprise Vue

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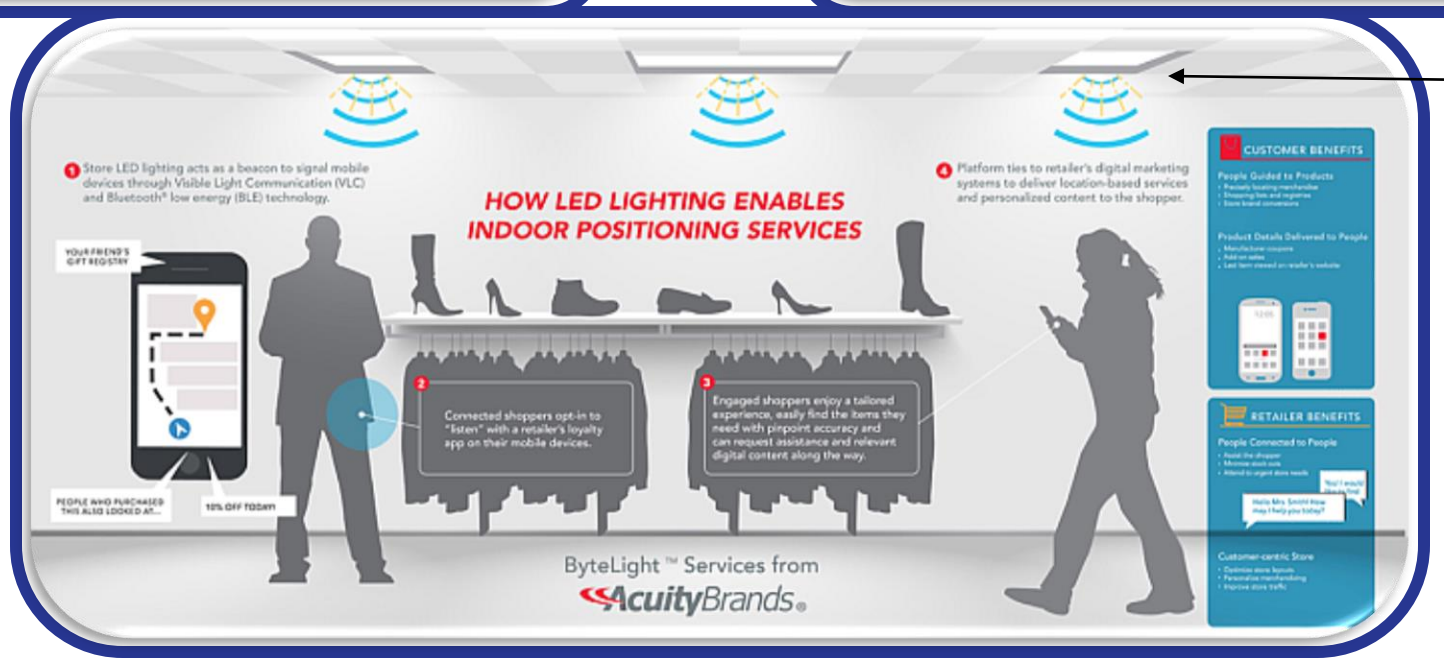
Indoor Positioning & Wayfinding

LEDs MAGAZINE

Target gives the go-ahead on IoT lights at half its stores

LLLC

LLLC



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Space Utilization

- Cost of Empty Space?

- Cost of Space Analysis

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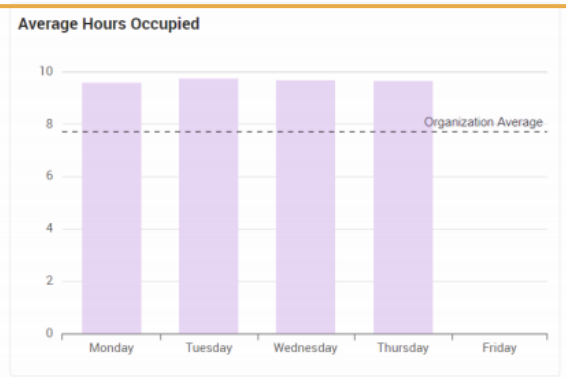

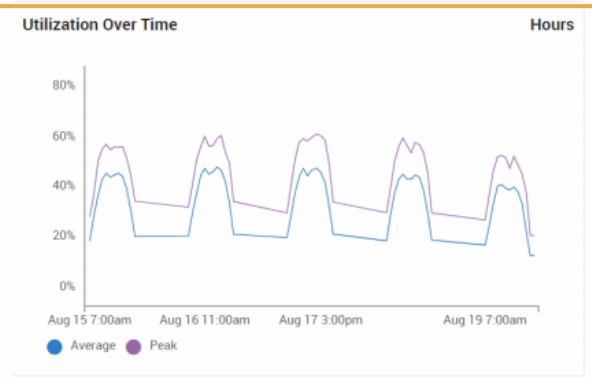

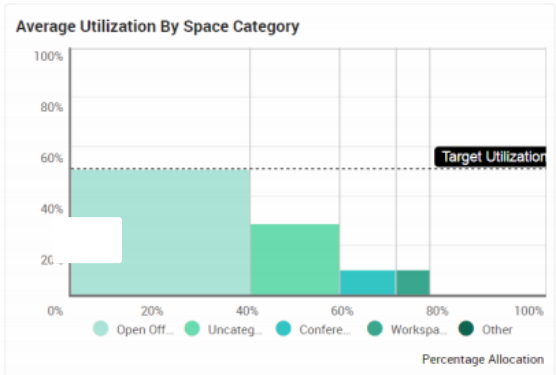

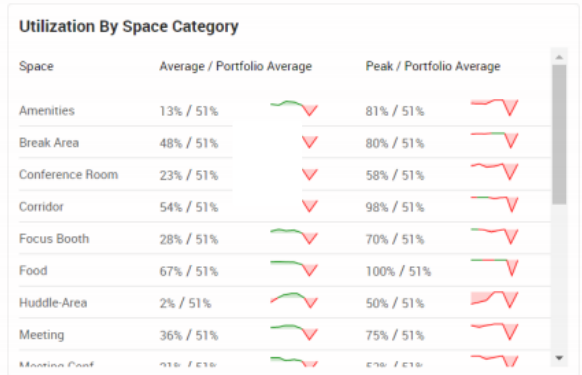

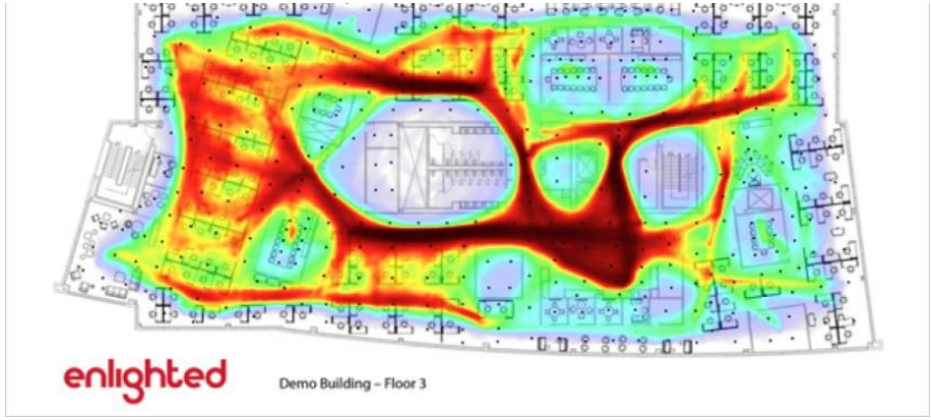

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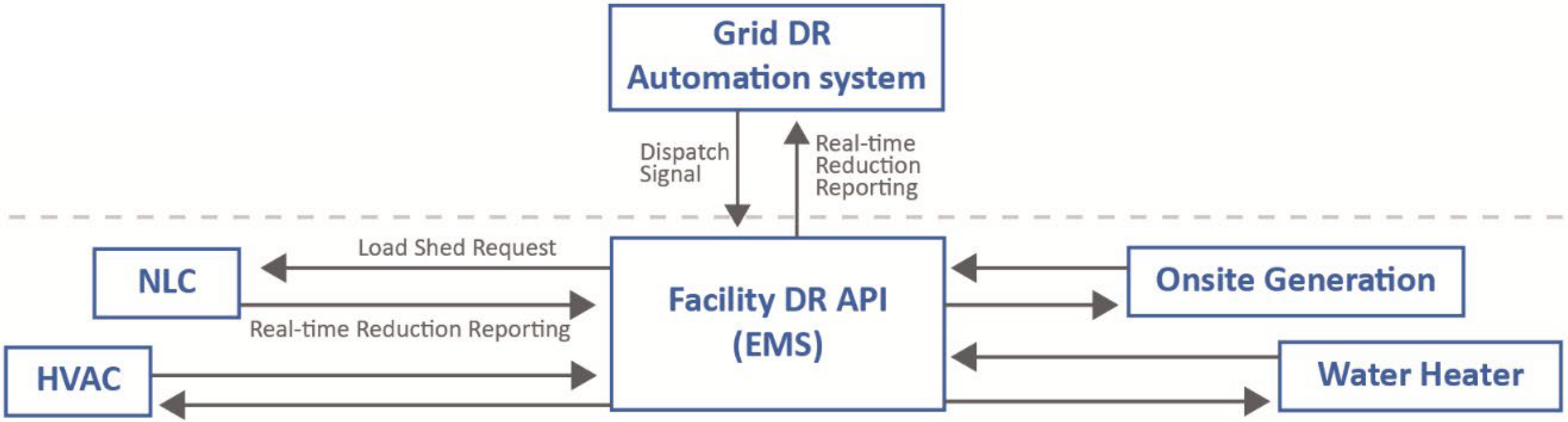
Demand Response (Traditional Operation: Sneaker-net)



Facility Professionals

Image by DLC

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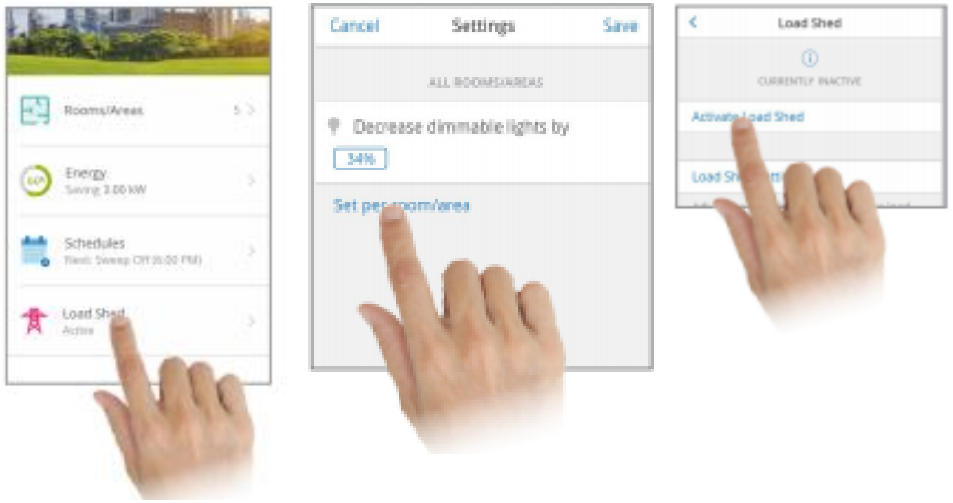
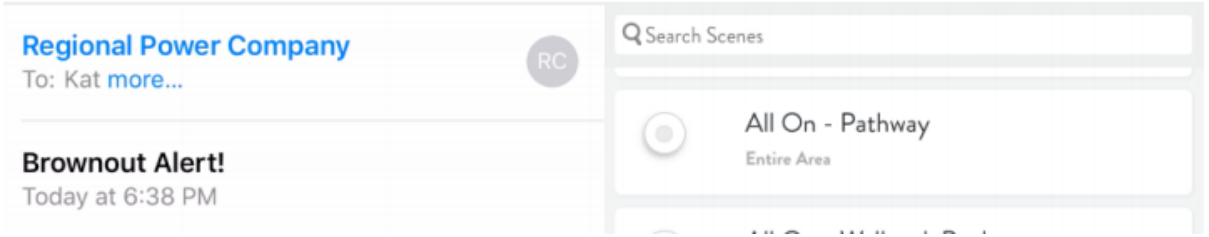
NLC/LLLC Automatic Demand Response

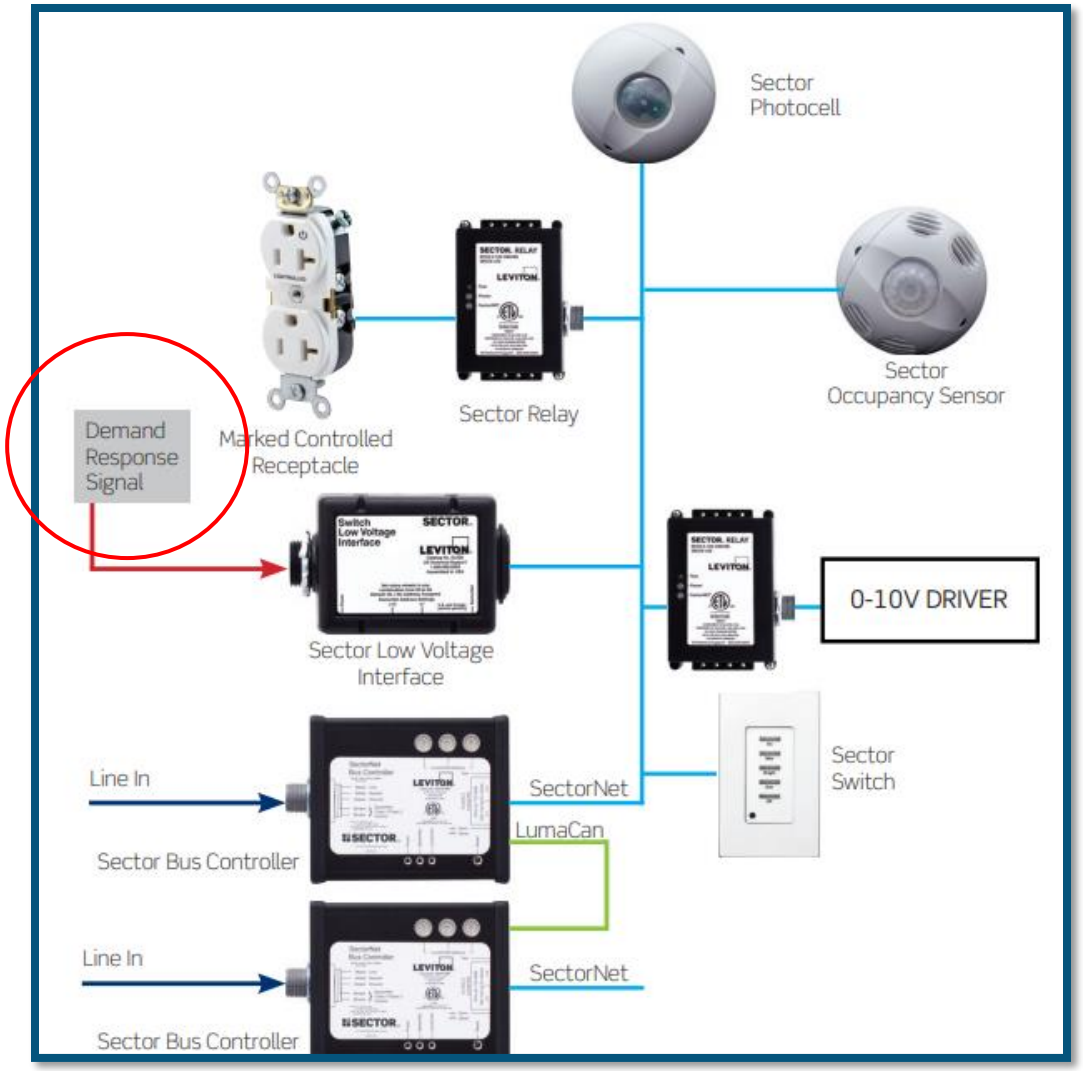
Lutron Vive



RAB LightCloud

When you receive a Demand Response alert from your utility, turn the Scene On.





Leviton Sector Distributed Lighting

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Asset Tracking

VA Pittsburg Healthcare Case Study

OSRAM EINSTONE Beacon Included

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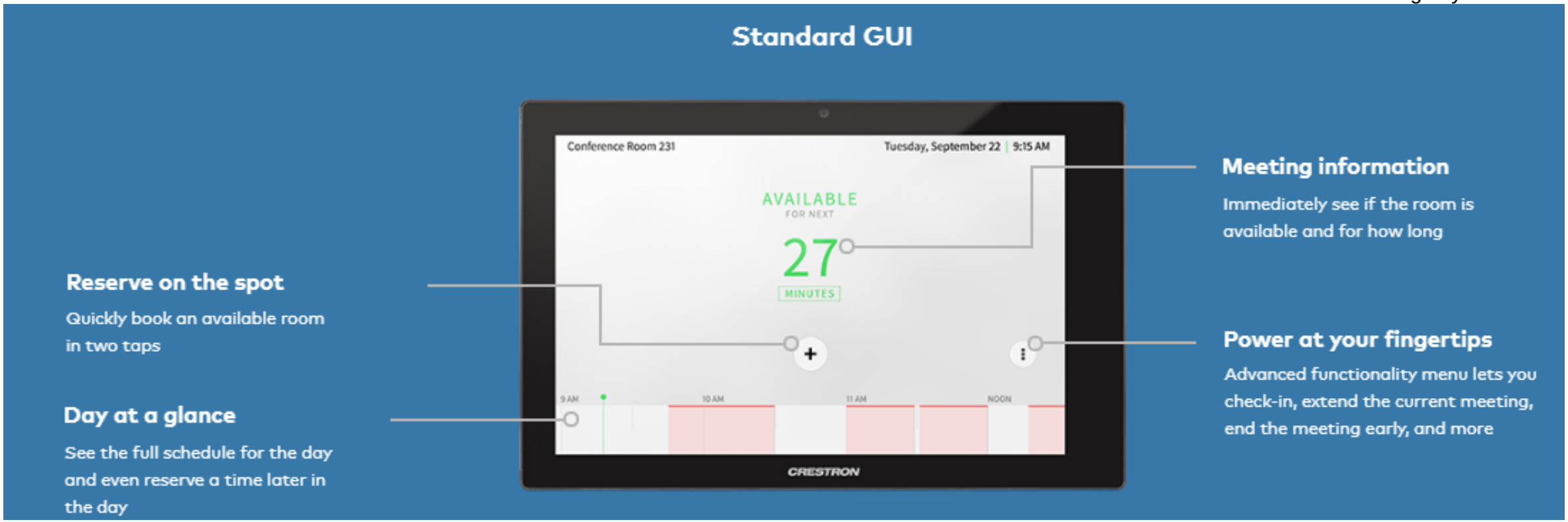
Room Scheduling

Image by Crestron



Tenants

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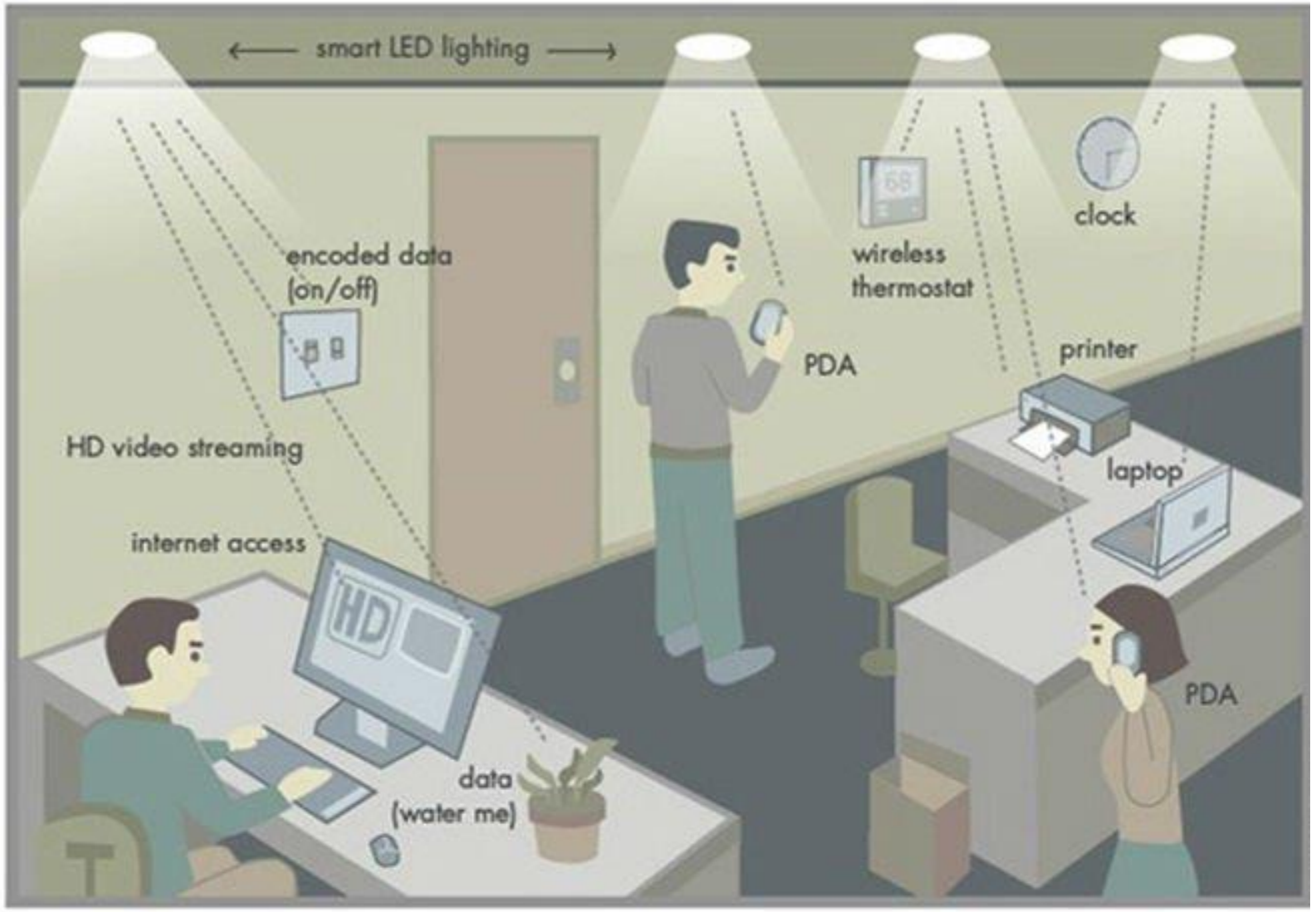
LLLC with Li-Fi – Hold onto your hats…

- WiFi: Transmit data through radio frequency
- LiFi: Transmit datas at high-speeds through visible light, UV, IR
- Trulifi from Signify



Take a second… Breathe… You're Probably Rambling… Maybe pause for questions

Tunable White Lighting

- Specific color tuning adjusting the correlated color temperature / SPD
- Meant to affect mood or alertness.
- Circadian lighting.
- Simple preference?

First, Do No Harm

IES's LD+A: 2020 *Emerging Markets Report*

Light and Health

"Most manufacturers did not set as a company mission to control the body or manipulate biological processes; rather, our ethos is based in enhancing architecture and creating comfortable environments. Using light to influence biological rhythms and functions could have unintended risks.

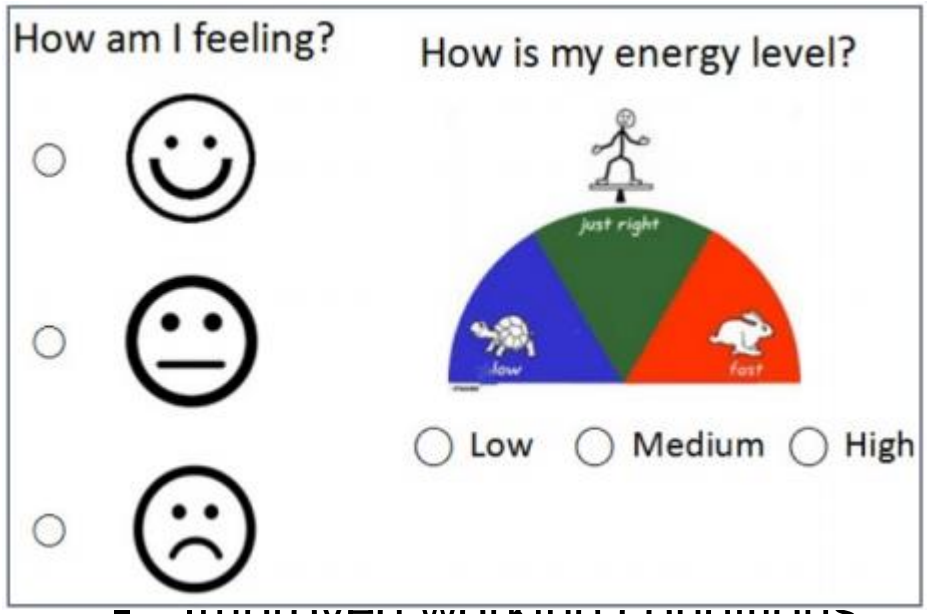
In the absence of definitive, reproduced, evidence-based studies and clear application methods, lighting manufacturers are loath to take on."

Mike Thornton, CMO
Focal Point

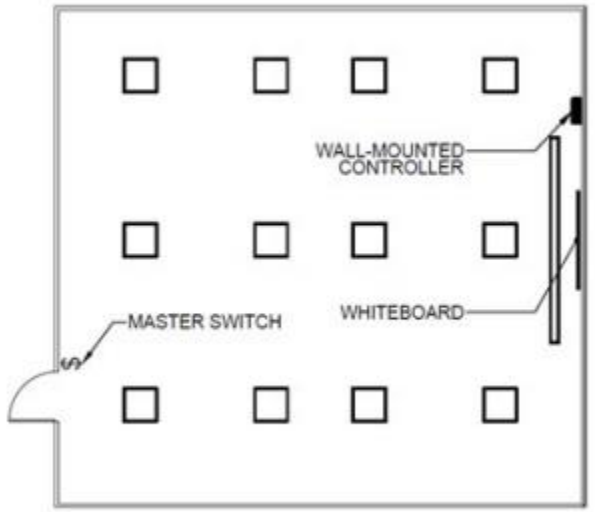
- We're in lighting, not doctors
- Leverage evidence-based guidance

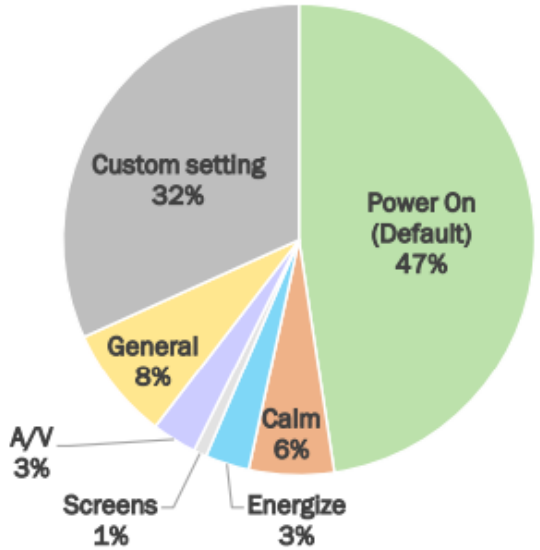
Tunable White in Classrooms – PNNL & DOE 2018-2019 Study

- Study Conclusions



- Improved working conditions and learning environment for teachers and students



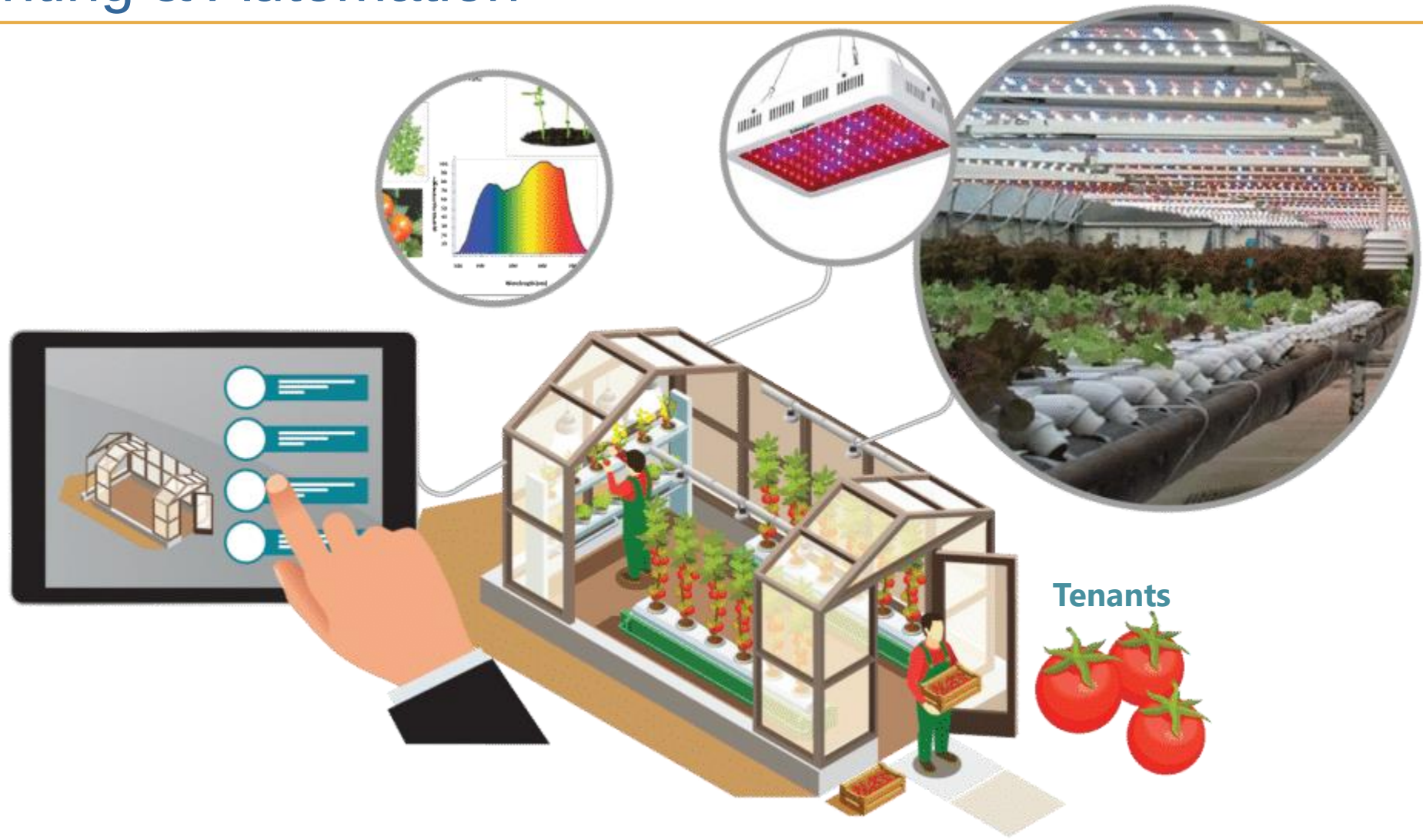


Horticultural Lighting & Automation

Facility Professionals

Owners

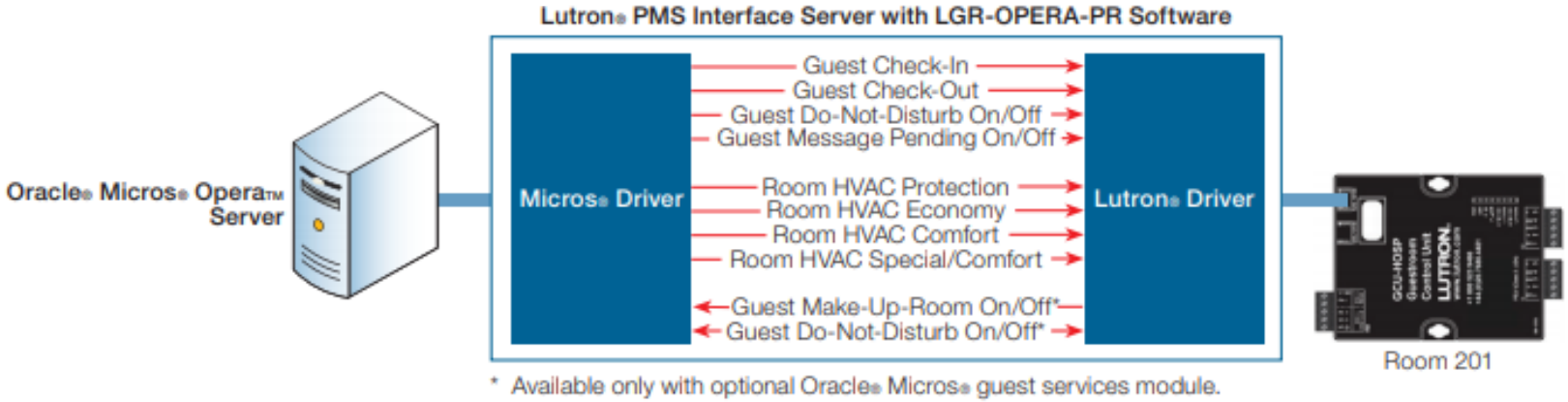
Implementers



The “Wow Factor” in Hospitality

- PMS Integration
  - Grand Welcome Scene
- GPD Algorithm
  - Lighting
  - HVAC
- DND/MUR
- CELS
- Whole Hotel View

Images by Lutron



The Road to Smart Cities Starts with Lighting – Exterior LLLC+

Tenants

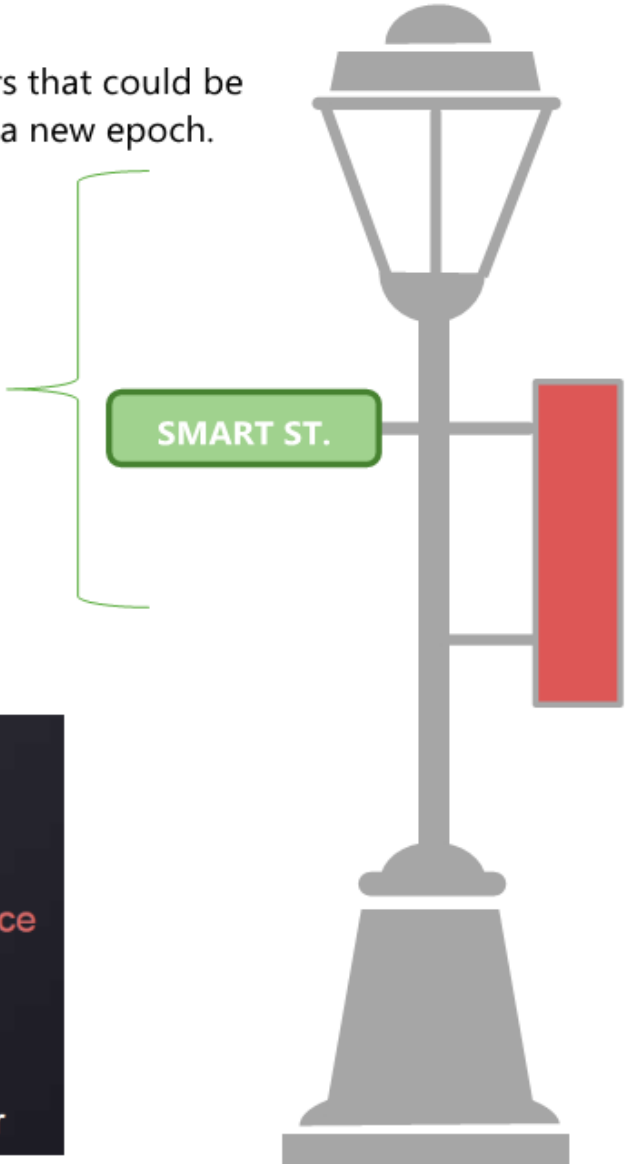
Owners ?

Billions and Billions...

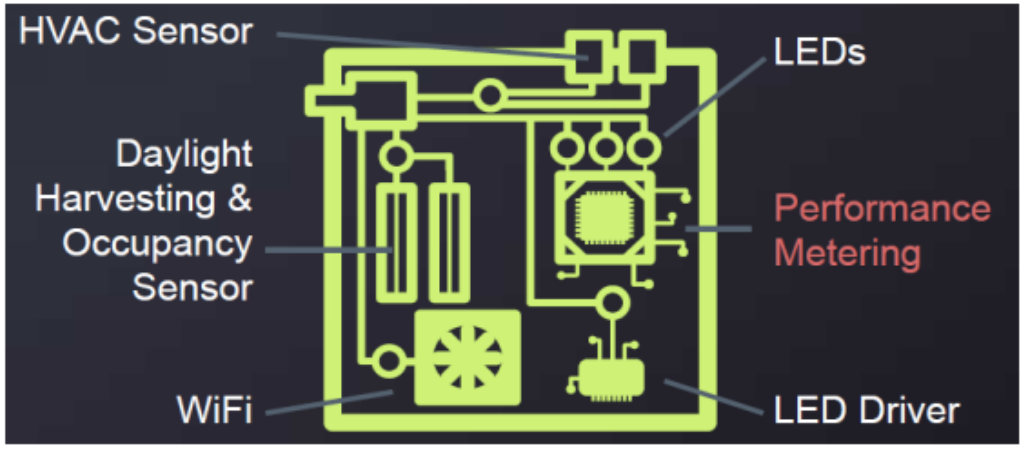
There really is no limit in site to the number or types of sensors that could be embedded into future luminaires. We are truly at the dawn of a new epoch.

What's in tomorrow's streetlight?

Parking Management	Concealed Speaker
Seismic Sensors	Wire Theft Detection
Digital Signage	Air Pollution Sensors
Public Wireless Networks	Gunshot Detection

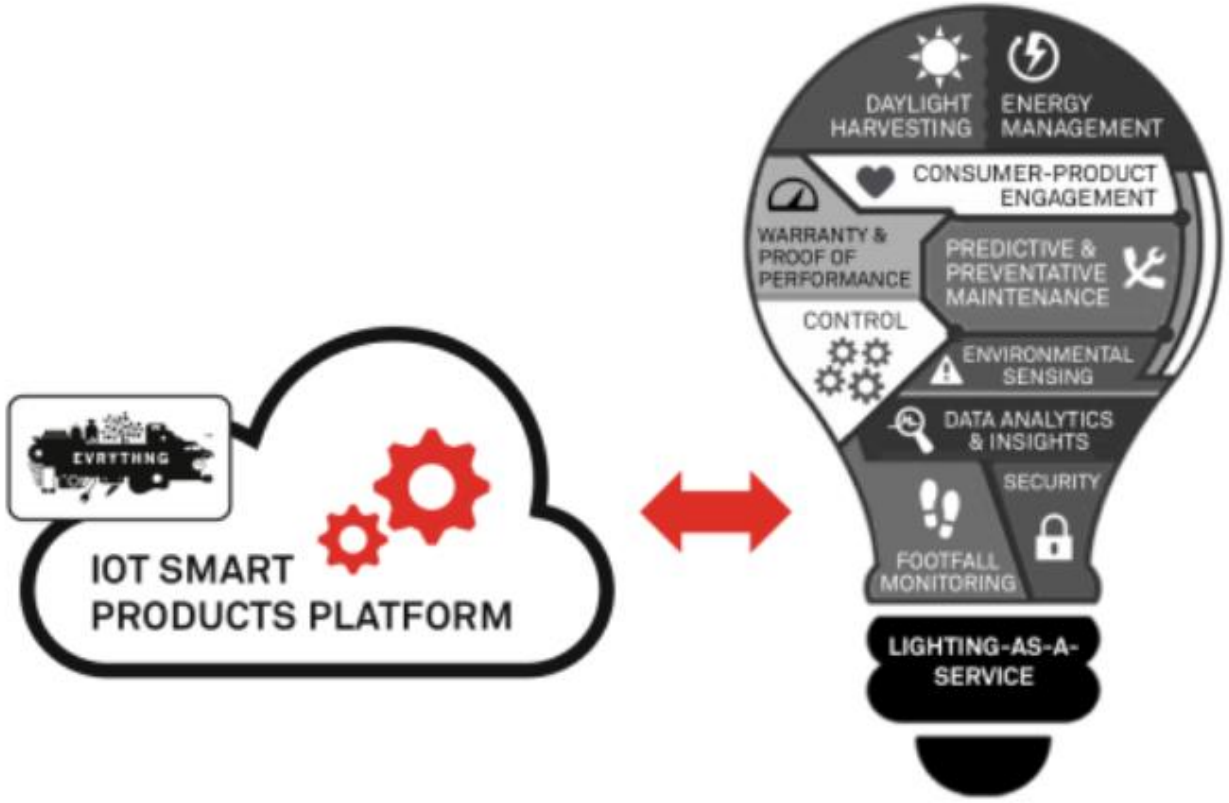


Look for continued system integration



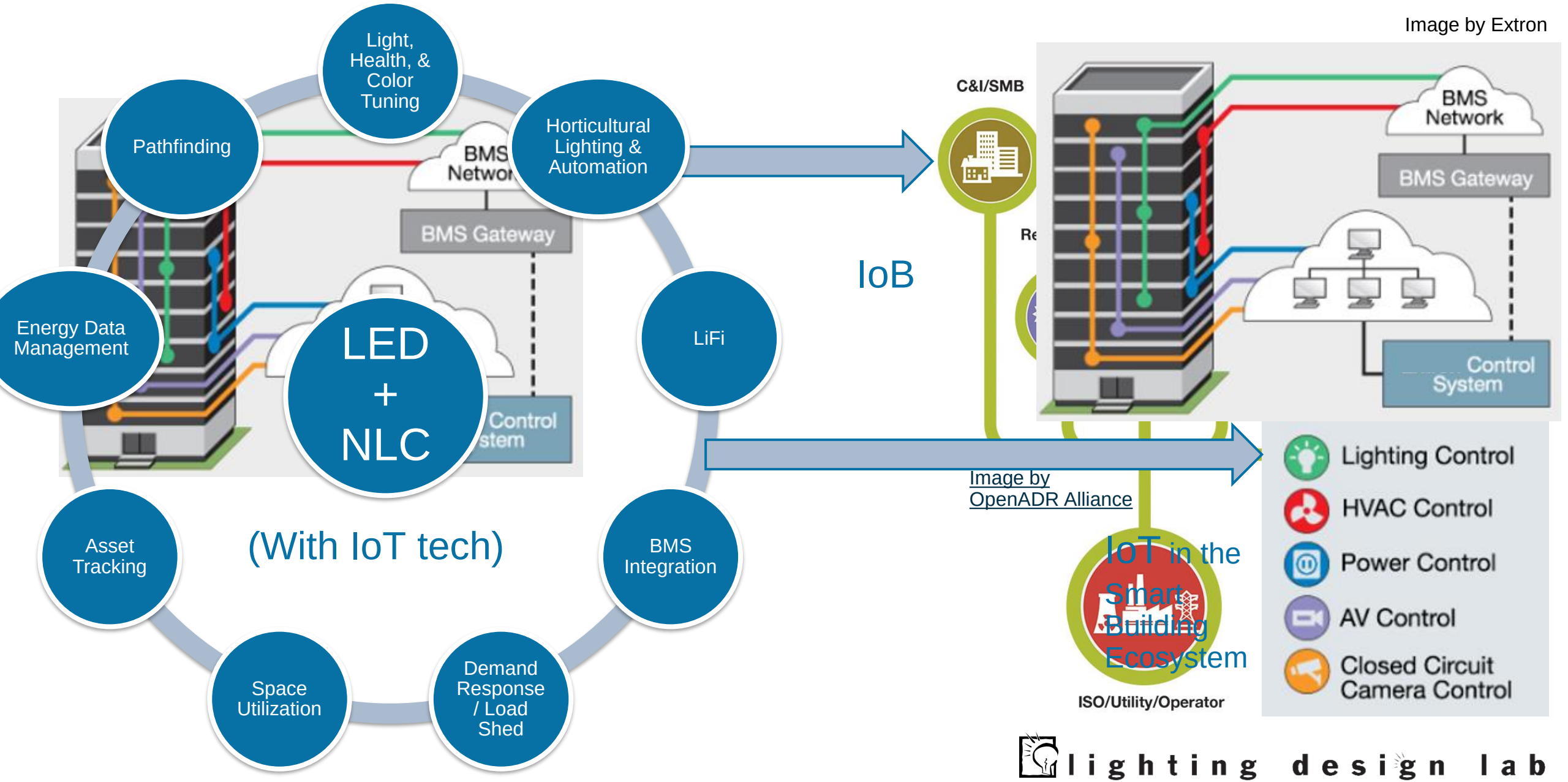
Interoperability with 3rd Parties with NLC/LLLC as Infrastructure

- Building vs. Campus Management
- Continuous [AI] Optimization
- Smart DER Operations
- Mitigate Physical & Cyber Security Risks



Observed Trend: From [LED+NLC] to [IoT] to [IoB]

Image by Extron



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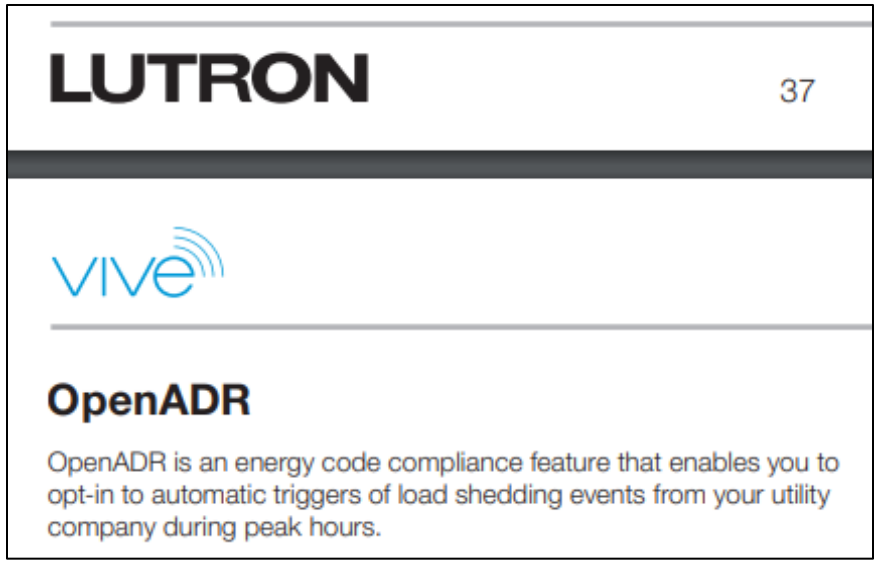
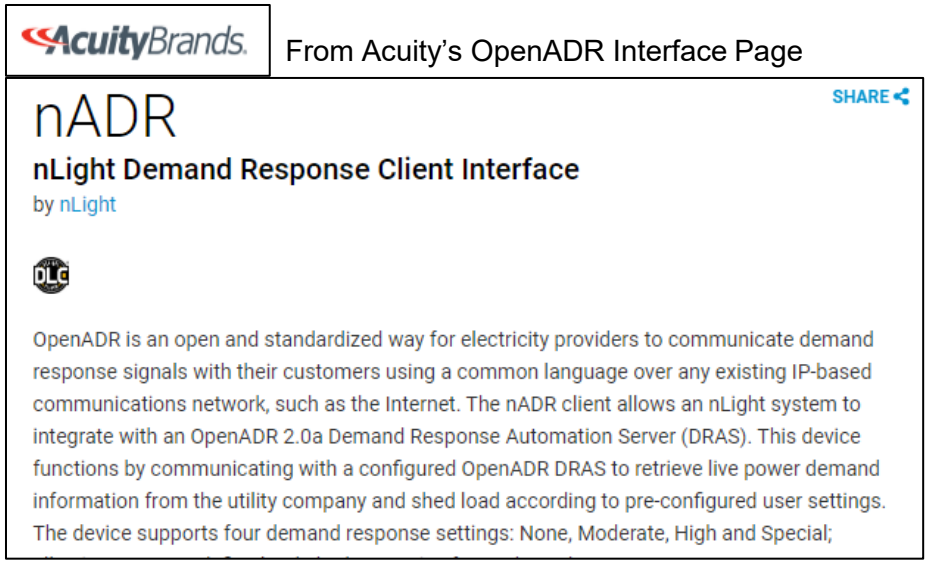
Examples of NLC Systems using the OpenADR Standard

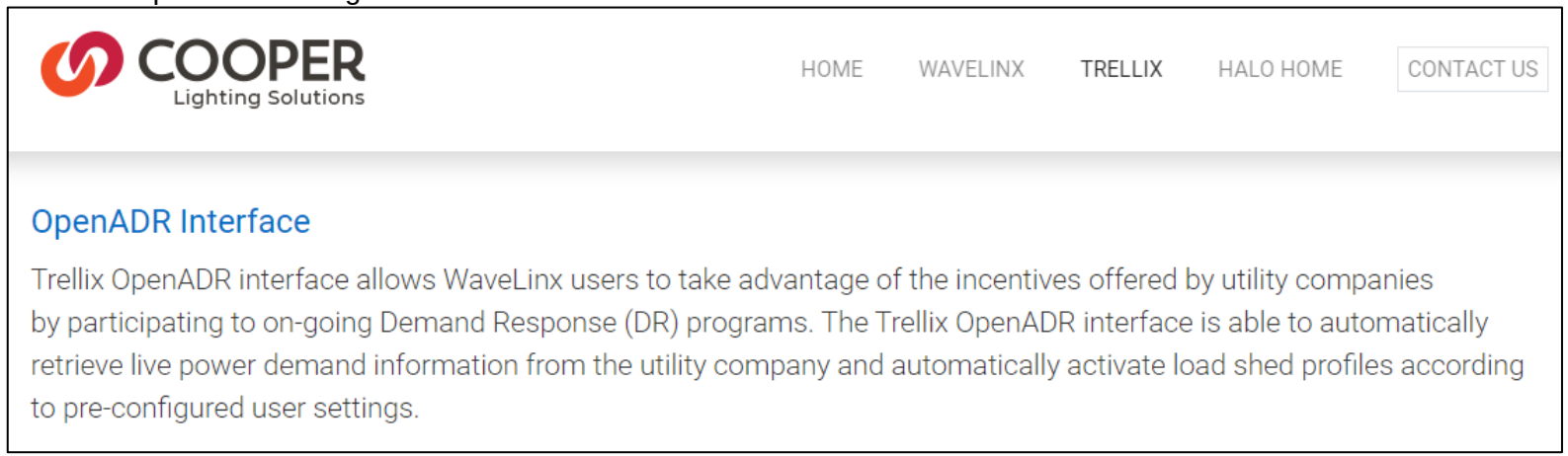
From Lutron Vive's Programming Guide



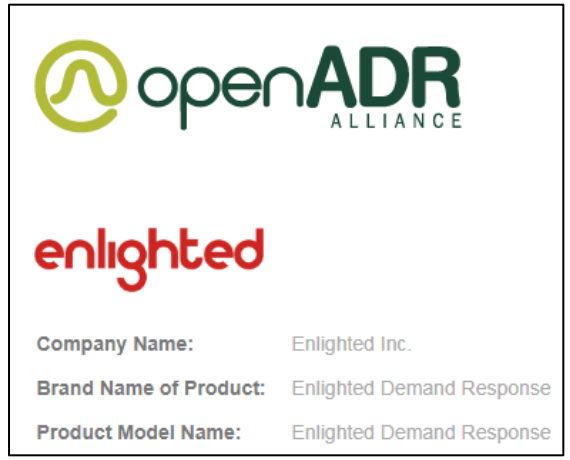
From Acuity's OpenADR Interface Page



From Cooper's Trellix Page



OpenADR listing Enlighted as a Member



Sample Data Set for NLC Manufacturer “SMARTS Race”

	Signify	Cooper Lighting	Lutron Electronics	Igor (PoE Lighting)	Acuity
NLC System	Interact Office	Wavelinx	Vive	Igor	nLight
Smart Platform	Interact Pro	Trellix	Vive Vue -> Enterprise Vue	Nexos	Eclypse -> Atrius
Shared Features	Reporting Dashboards, System Control & Diagnostics, Dynamic Scheduling, Energy Monitoring, BMS Integration (digital), HVAC Integration (digiral and analog), Floorplan View, Luminaire Level Lighting Control, Space Utilization Reporting, Tunable White Control, Open API				
Unique Features	Energy Optimization, System Asset Mgt, Room Scheduling, Scene Mgt, Indoor Positioning, Pathfinding, Bio-Adaptive Lighitng	Energy Optimization, System Asset Mgt Asset Tracking, Room Scheduling, Security Integration, Demand Response via OpenADR	Aggregate Lutron Systems' data, Demand Response via OpenADR	Pair almost any device (analog or digital), Asset Tracking, Room Scheduling, Security Integration Air Quality Monitoring	Asset Tracking, Contextual Spatial Analytics, Indoor Positioning, Demand Reponse via OpenADR
DLC QPL?	Yes	Yes	Yes	Yes	Yes

From Each Manufacturer’s Sell Sheets

Pause for Questions

Utility & Industry Resources – Teamwork Makes the Dream Work

Why Utilities like City Light Care About Connected Lighting?

Cost Effective Energy Savings

Ensures optimal project savings for lifetime of EE upgrade

Elite Customer Service

Relationship with customers for continuous improvements

Gateway to Connected Stuff

Keeps utilities relevant and part of the solution

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Benefits of plugging in to your Territory Utility

- Investment on innovation and energy efficiency
- Customer and technical support on specific projects
  - Or access to resources for these
- Access to tools and resources
- Access to encyclopedia of implementation knowledge
- Access to impactful programming

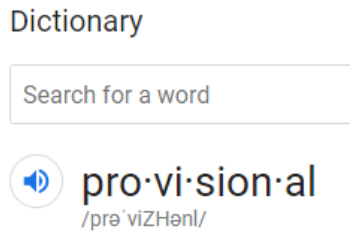
Program Design *Considerations:* **Savings & Incentives**

Example of prescriptive savings in City Light's lighting program

Space Use Type	Networked Lighting Controls	Luminaire Level Lighting Controls
Break Room	40%	50%
Classroom	25%	25%
Hallway	40%	50%
Lobby	40%	50%
The Loo	40%	50%
Warehouse	40%	50%

And so on and so forth…

Regional Technical Forums: Non-Residential Lighting Retrofits protocol



1. Arranged or existing for the present, *possible to be changed later*

Simplify Approach:

- prescriptive savings
- prescriptive incentives

Right-Sized Incentive

- $50-75 incentive bonus –

In addition to performance savings!

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PNW Regional Resources

Take a load off (literally). Join the Network.

BONNEVILLE POWER ADMINISTRATION

neea

NEEC
NORTHWEST ENERGY EFFICIENCY COUNCIL

Northwest Power and Conservation Council

TRADE ALLY NETWORK NW
Building Success Together

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Regional Technical Forum

NORTHWEST LIGHTING NETWORK

INTEGRATED DESIGN LAB
UNIVERSITY of WASHINGTON

DOE & PNNL – Integrated Lighting Campaign

ILC Goals

Provide resources for new integrated lighting systems


Promote use of innovative lighting sensors


Encourage integration with other building systems such as HVAC and plug loads


Document and recognize integration and innovation

- **Participants**
  - Organizations—including building owners, operators, and managers—have access to resources and technical assistance
- **Supporters**
  - Supporting partners include utilities, manufacturers, energy-efficiency organizations, lighting designers, and energy service companies (ESCOs)

integratedlighting@pnnl.gov

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Education & Market Development

1 & 2 Day NLC Workshops
for
EVERYBODY…
featuring
Hands-On Learning & Practical Application

LDL's Flagship Workshop

- Specifics of control methods
- Developing sequence of operations
- Specification writing & interpreting
- System design & set up
- And so much more!!!

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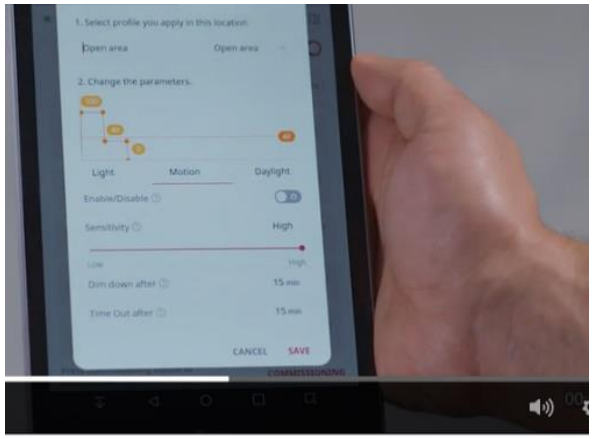
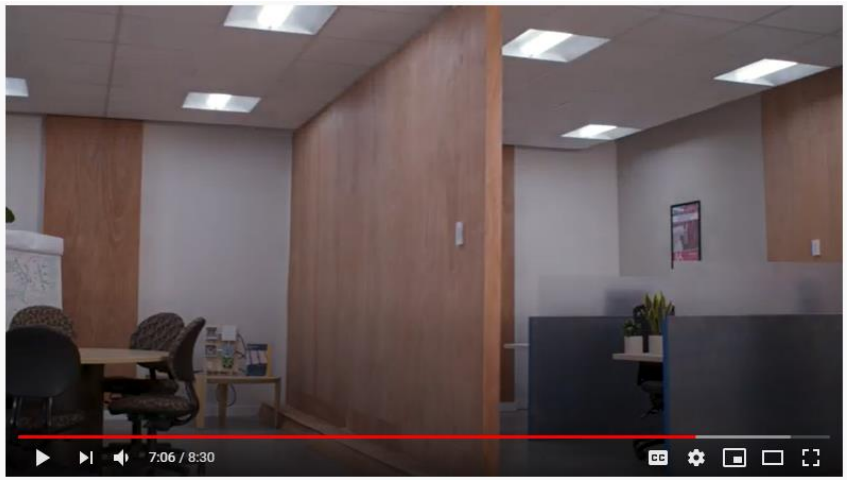
Networked Lighting Controls Learning Guides & Video

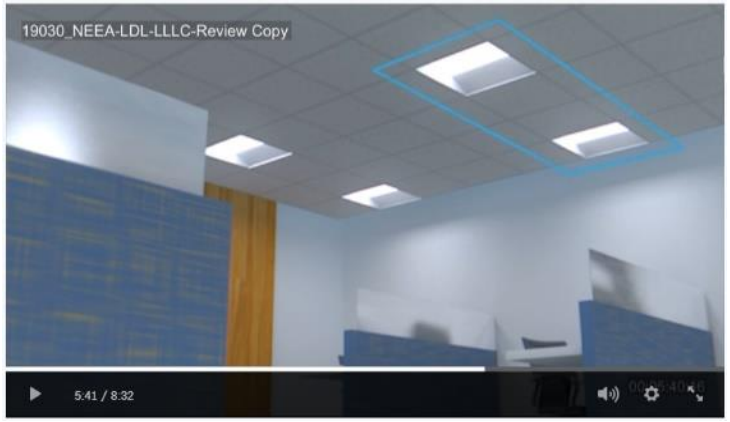
- LLLC Video
  - X3 short vids
  - ***Demonstrates*** primary control strategies
  - Simulates tenant improvement to highlight system flexibility
- For utility staff, TA's / DA's / Customers

CHECK IT OUT!

Click here to watch now!







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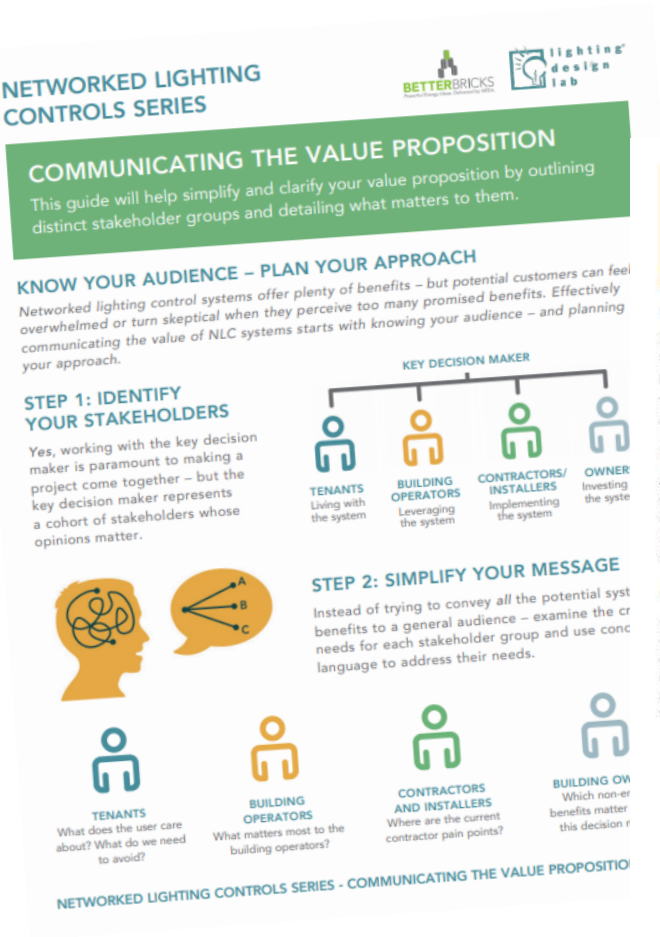
NLC / LLLC Best Practice Guides



NETWORKED LIGHTING CONTROLS SERIES

BETTERBRICKS

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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.

KEY DECISION MAKER

TENANTS Living with the system

BUILDING OPERATORS Leveraging the system

CONTRACTORS/ INSTALLERS Implementing the system

OWNER Investing the syste

STEP 2: SIMPLIFY YOUR MESSAGE

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

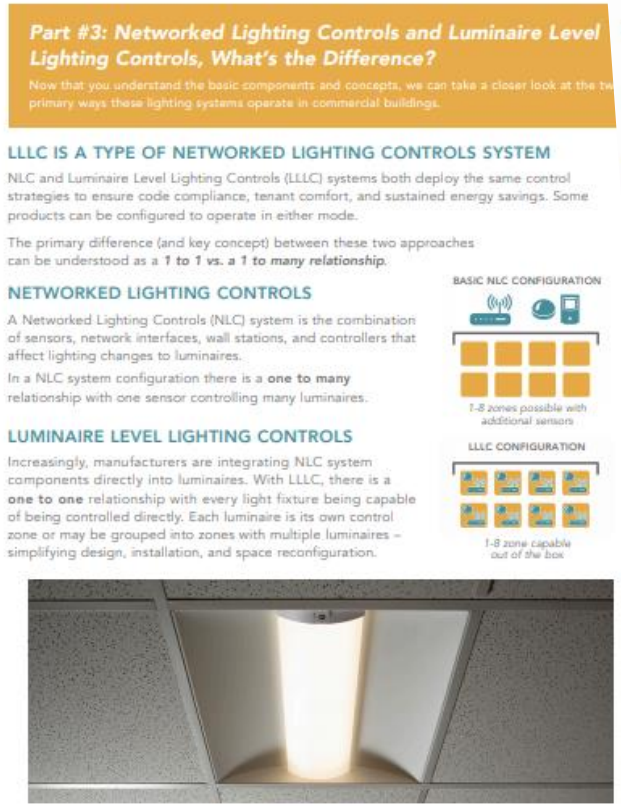
TENANTS
What does the user care about? What do we need to avoid?

BUILDING OPERATORS
What matters most to the building operators?

CONTRACTORS AND INSTALLERS
Where are the current contractor pain points?

BUILDING OW
Which non-er benefits matter this decision r

NETWORKED LIGHTING CONTROLS SERIES - COMMUNICATING THE VALUE PROPOSITIO



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 tw 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 1 vs. a 1 to many 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.

BASIC NLC CONFIGURATION

1-8 zones possible with additional sensors

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.

LLLC CONFIGURATION

1-8 zone capable out of the box

NETWORKED LIGHTING CONTROLS SERIES - CONTROL TECH TERMS 3

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

NETWORKED LIGHTING CONTROLS SERIES - PRIMARY CONTROL STRATEGIES 2

NETWORKED LIGHTING CONTROLS SERIES

BETTERBRICKS

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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.

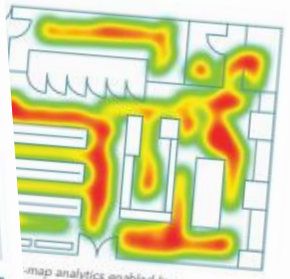
lighting and controls industry is moving rapidly towards a future where connected lighting e communication and infrastructure backbone for the Internet of Things (IoT). Networked ng controls will play a key role as we enter the era of smart buildings, connected unities, and smart cities.

ITING WILL BE THE BACKBONE OF THE IOT

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

ift to IoT is occurring as an increasing number ts employ integrated sensors such as LLLC

f sensors now being integrated into luminaires the application. Office lights are equipped with can talk to HVAC. In retail applications, infrared h detecting sensors embedded in the lights track pping patterns.



-map analytics enabled by 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.

NETWORKED LIGHTING CONTROLS SERIES - EMERGING TECHNOLOGY TRENDS 1

[Click to access the LDL networked lighting control learning guides]

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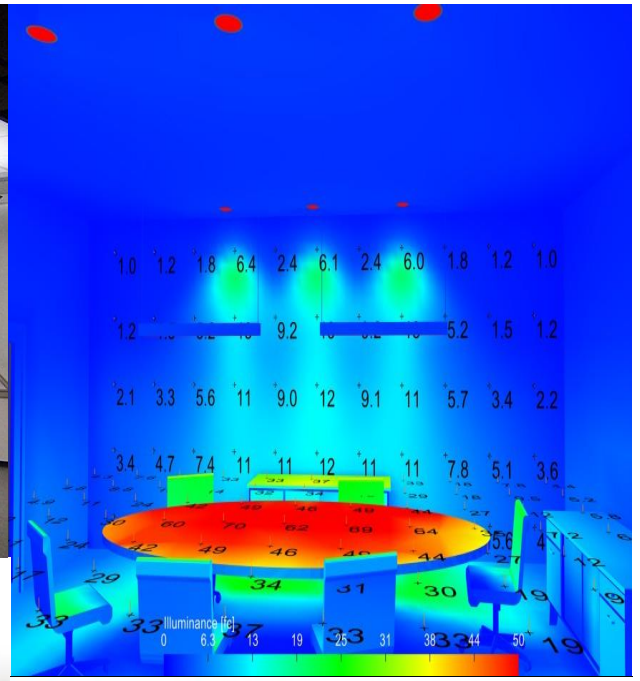
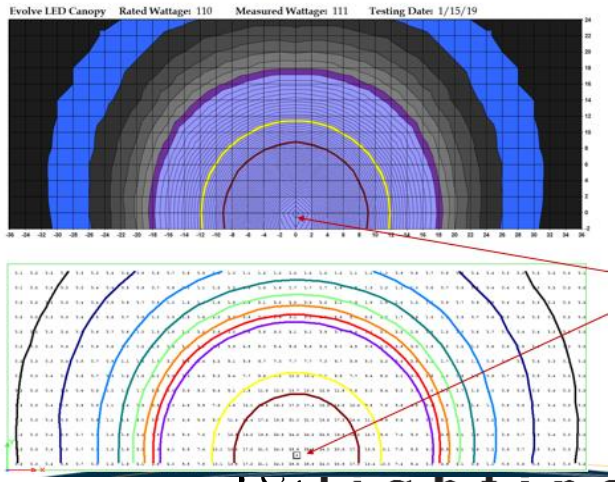
Project Specific Consults



Comparing the tested sample (top) to the IES file (bottom)



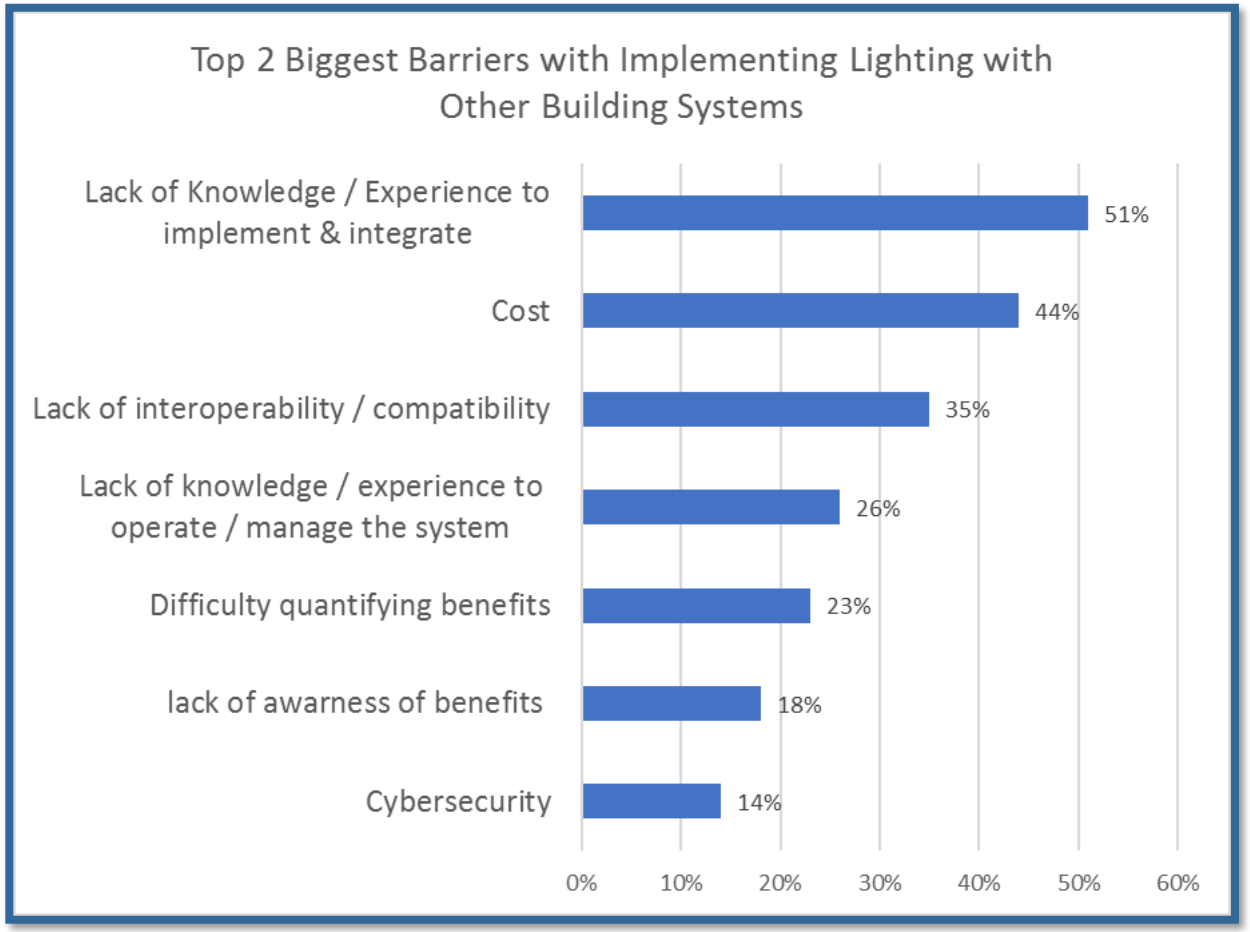
Pause for Questions

Simplify the Message, Grab the Stakeholder's Attention

Poll: Top 2 Barriers to NLC and Their NEB's Implementation

A Similar Poll…

June 10th, 2020



Thank you – Better Buildings, Gabe Arnold, & Felipe Leon

Integrated Lighting Campaign

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Lighting Audit: Make a First Impression

- Attend LDL Audit & Retrofit Class ;)
- Benchmark Existing Conditions
- Estimate Energy, Labor, Rebate Savings
- Propose Multiple Solutions, Model kWh Savings
- Lead to Life Cycle Analysis and Non-Energy Benefits
- Tell a Story from Audit to Proposal

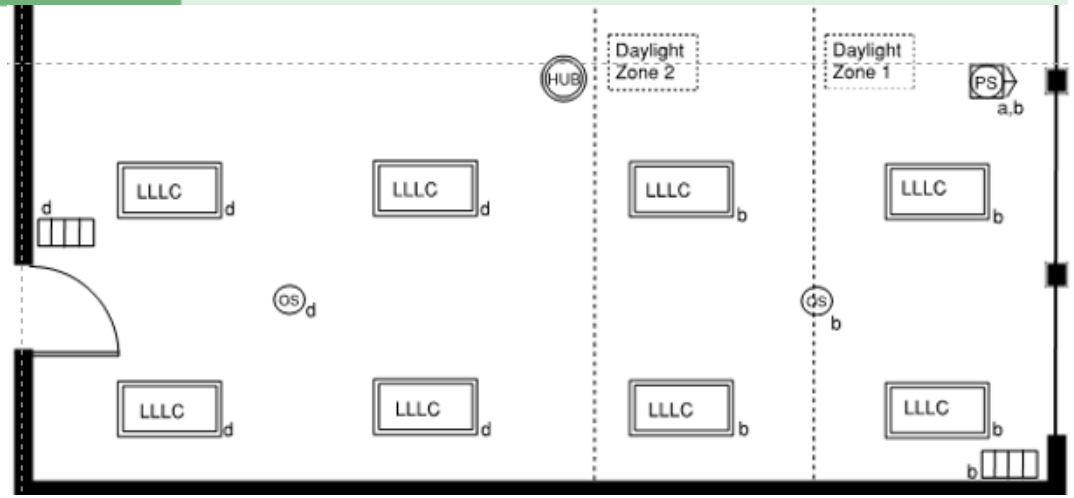
	LED
Annual kWh Reduction:	19,783
% kWh Reduction (of existing lighting):	78%
Annual Utility Electric Savings:	$2,461
Annual Lamp/Ballast Maintenance Savings:	$2,619
Rebate Savings:	$3,500
Total Savings:	$8,580
Upgrade Cost:	$20,000
Estimated Labor Cost	$5,000
Net Project Cost:	$25,000
Simple Payback (years):	2.91

NLC Key Collaboration Tool: **Sequence of Operations**

The Sequence of Operations communicates intent

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

	CONTROL METHOD				
SPACE TYPE	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	



[Click to access LDL Sequence of Operations learning guide]

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User Interface as Part of the Value Proposition

From manually coding to smart devices

MORSE CODE

A •–	M ––	Y –•––
B –•••	N –•	Z ––••
C –•–•	O –––	1 •–––––
D –••	P •––•	2 ••–––
E •	Q ––•–	3 •••––
F ••–•	R •–•	4 ••••–
G ––•	S •••	5 •••••
H ••••	T –	6 –••••
I ••	U ••–	7 ––•••
J •–––	V •••–	8 –––••
K –•–	W •––	9 ––––•
L •–••	X –••–	0 –––––

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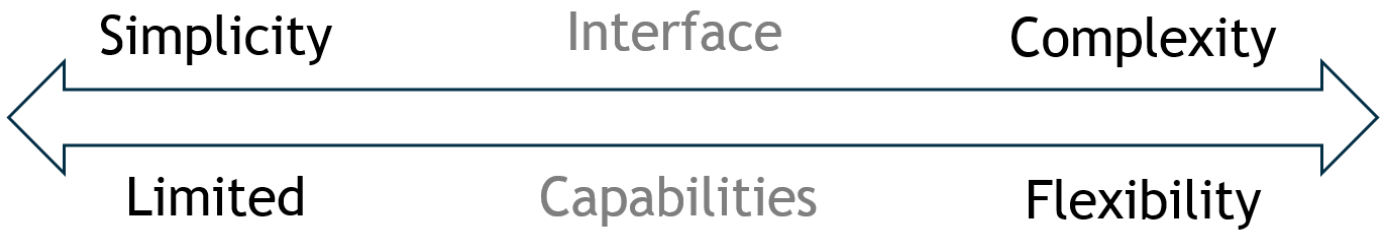
Key for Tenants: Wall Stations

- Another scope ‘gray area’
- As NLC/LLLC systems become more flexible, wall station SOO is key to organization.



Key for Facility Professionals: Configuration Tools

Configuration tools are great when they provide

- An ordinal process
- Visual confirmation of settings
- Integral help features

Some are still pretty confusing!

Not every system uses an app

Implementers – Leverage Partner's Procedural Efficiency

- Quoting tools
- Project Development tools
- One lines with Packaging
- Room Packaging
- Pre-Pairing
- Pre-Commissioning

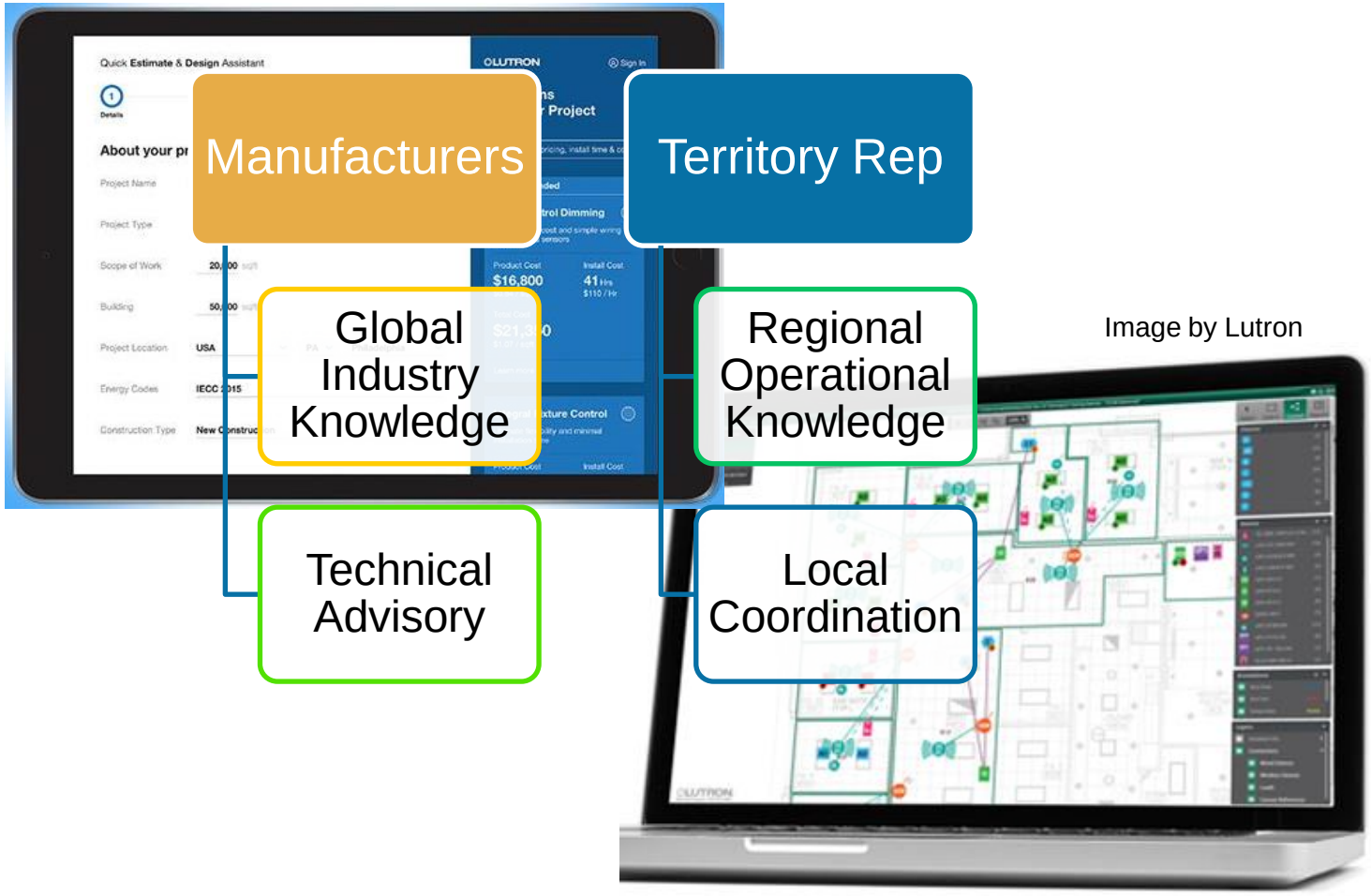


Image by Lutron

Implementers

Owners

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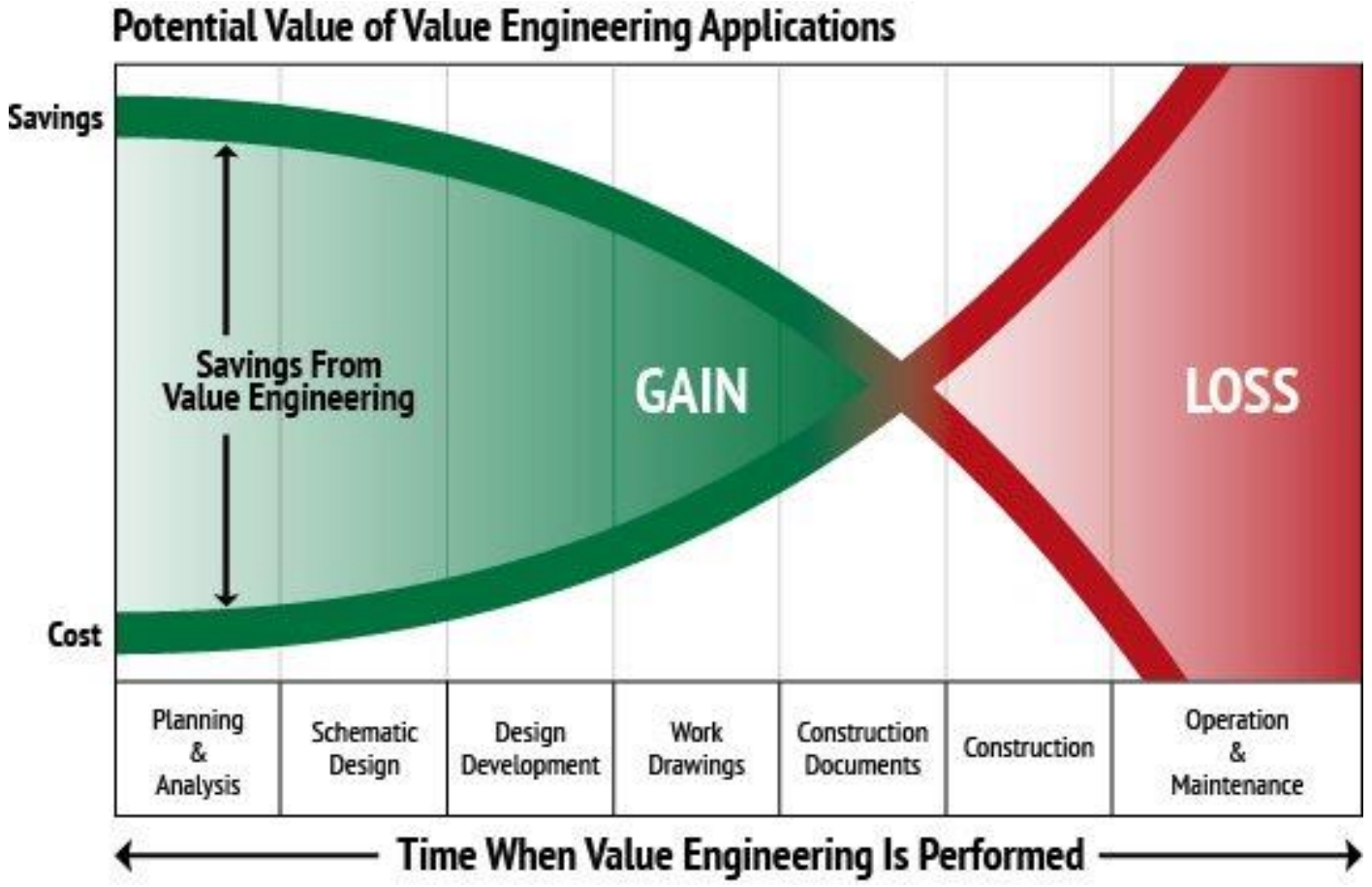
Not “Value” and not “Engineering”

- Removes hardware / features last minute to reduce cost
- Other Building contractors up-sell
  - EC typically down-sell
- True value engineering “adds” to up-front cost to reduce life-cycle cost



Pause for Questions

Financial Conversations

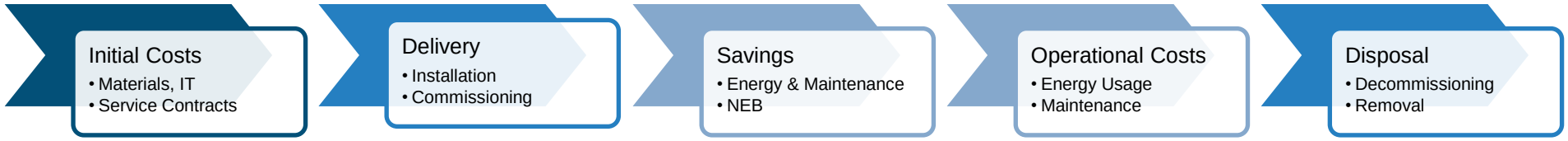
Simple Payback vs. Life Cycle Cost

Simple Payback

$$\frac{\text{(Cost of Materials + Labor + Services) – Rebates}}{\text{(Energy Savings per year + Maintenance Savings per Year)}}$$

Life Cycle Cost Analysis

System Life (i.e. 10-20+ years)



Simplified 10-Year Example

Discount Rate:	10%										
Date:	**Today**	**End of Year**	**End of Year**	**End of Year**	**End of Year**	**End of Year**	**End of Year**	**End of Year**	**End of Year**	**End of Year**	**End of Year**
	0	1	2	3	4	5	6	7	8	9	10
Cash Outflows											
Lighting System:	$(65,400.00)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Rebate Incentives:	$ 15,400.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Outflow:	$(50,000.00)										
Cash Inflows											
Energy Savings:		$10,000.00	$10,300.00	$10,609.00	$10,927.00	$11,255.00	$11,593.00	$11,941.00	$12,299.00	$12,668.00	$13,048.00
Maintenance Savings:		$ 5,000.00	$ 5,150.00	$ 5,305.00	$ 5,464.00	$ 5,628.00	$ 5,796.00	$ 5,970.00	$ 6,149.00	$ 6,334.00	$ 6,524.00
Inflows:		$15,000.00	$15,450.00	$15,914.00	$16,391.00	$16,883.00	$17,389.00	$17,911.00	$18,448.00	$19,002.00	$19,572.00
Annual Cash Flows:	$(50,000.00)	$15,000.00	$15,450.00	$15,914.00	$16,391.00	$16,883.00	$17,389.00	$17,911.00	$18,448.00	$19,002.00	$19,572.00
PV of Cash Flows:	($50,000.00)	$13,636.36	$12,768.60	$11,956.42	$11,195.27	$10,483.01	$9,815.64	$9,191.18	$8,606.13	$8,058.70	$7,545.85
	10-Year	**Year-1**	**Year-2**	**Year-3**	**Year-4**	**Year-5**	**Year-6**	**Year-7**	**Year-8**	**Year-9**	**Year-10**
NPV:	$53,257.17	($36,363.64)	($23,595.04)	($11,638.62)	($443.34)	$10,039.67	$19,855.31	$29,046.48	$37,652.61	$45,711.31	$53,257.17
Simple Payback:	3.19										
ROI:	34%										

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Right Postage, Right Address: The Proposal

- Key Components
  - Title and Subtitle
  - Target
  - Problem statement
  - Financial Summary
  - Payment Terms
  - Current Status
  - Action -> PO
  - Appendix(es)

One Page Proposal

20% more Light with 40% Lower Energy Cost for the Parking Garage at 123 Project St.

Improving security, saving energy, lowering operating costs, and boosting the Energy Star score

Target: TO IMPROVE PARKING-AREA LIGHTING WITH ENERGY EFFICIENT, LONG-LASTING LED TECHNOLOGY

- To Address tenant safety concerns by increasing average lighting levels by 20% and moving to "whiter" light, enhancing visibility for both occupants and security camera.
- To reduce operating and maintenance costs for parking-area lighting by $15,000 the first year (10-year NPV of over $53,000.
- To capture $15,400 in Energy Trust incentives, covering 24% of project costs
- To avoid a quarter-million pounds of CO2 emissions annually, boosting ENERGY STAR score to 70 from 68

Financial: Project first cost is estimated at $50,000 after a utility incentive of $15,400. A 10-year analysis yields a net present value of $53,256 and a simple payback of 3.3 years.

Simple Payback	3.2 years
Net Present Value*	$53,256
Return on Investment	34%

* NPV Assumes 10-year analysis term, 10% discount rate

Lighting as a Service = Netflix and Lit?

- No up-front capital costs
  - Equipment, Commissioning, Maintenance by Provider
  - Monthly Payment from Savings
- Energy Metering
- Contract with Provider and Implementer

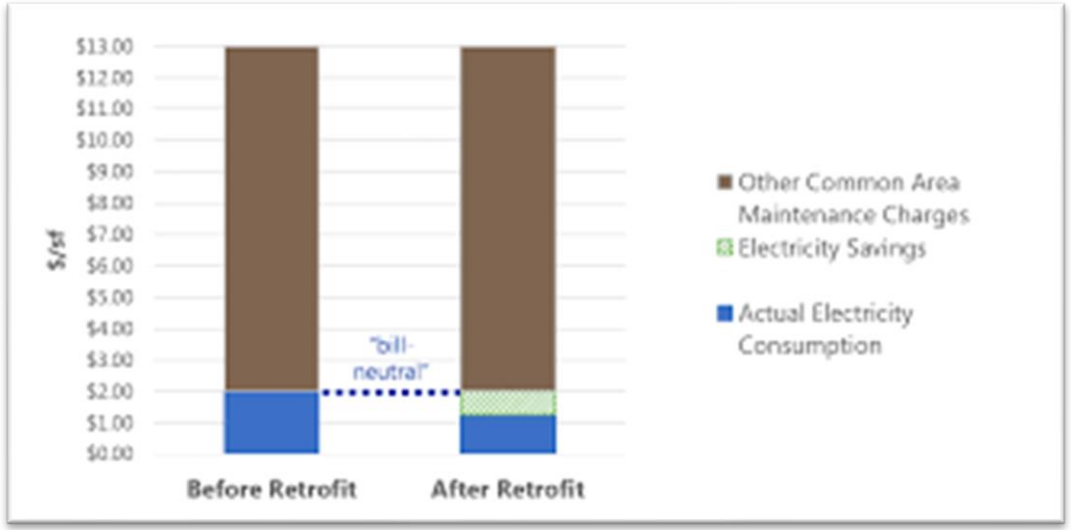
Seattle City Light EEaS Pilot

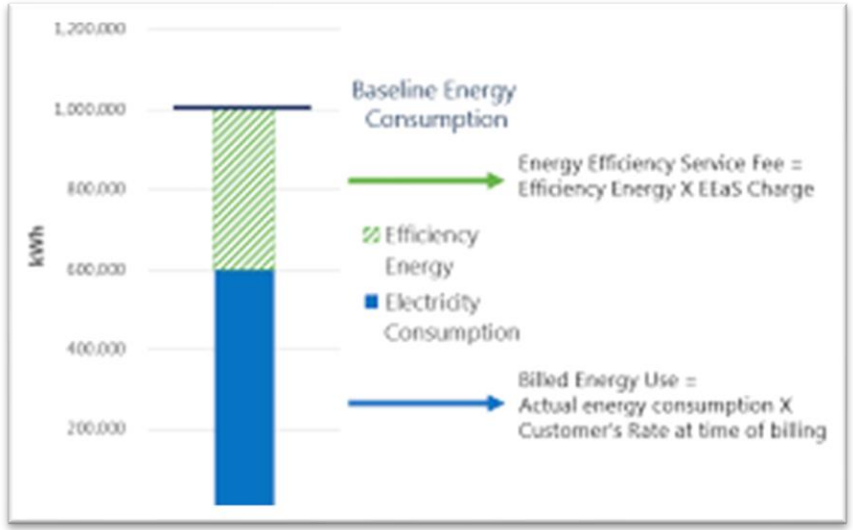
RENEWABLE ENERGY WORLD

Energy Efficiency, News

Seattle City Light is piloting America's first Energy Efficiency-as-a-Service program

By Jennifer Runyon | 6.19.20





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Commercial Building Tax Deduction 179D

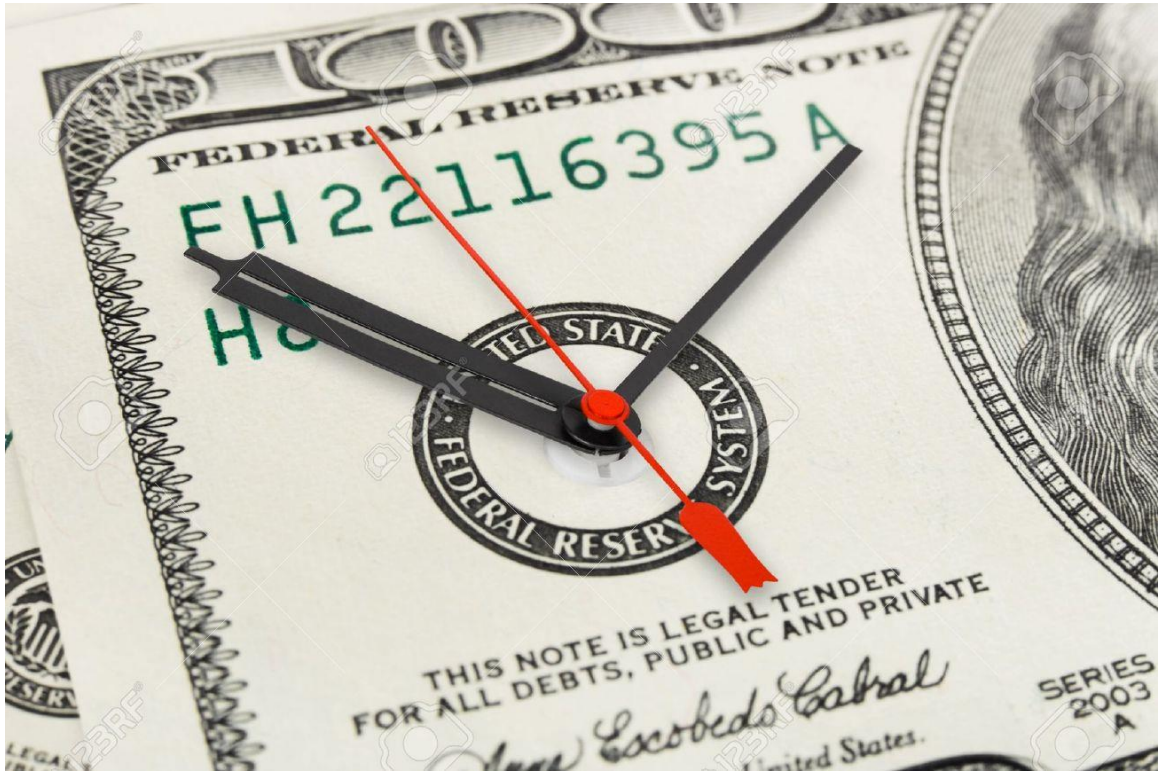
A tax deduction of $1.80 per square foot

SUMMARY OF 179D TAX DEDUCTIONS

	Fully Qualifying Property	Partially Qualifying Property				Interim Lighting Rule
		IRS Notice (Effective Dates)	Envelope	HVAC and HW	Lighting	
Savings Requirements*	50%	2006-52 (1/1/06 - 12/31/08)	16 2/3%	16 2/3%	16 2/3%	25%-40% lower lighting power density (50% for warehouses)
		2008-40 (1/1/06 - 12/31/13)	10%	20%	20%	
		2012-26 (3/12/12 - 12/31/20)	10%	15%	25%	
Tax Deduction (not to exceed cost of qualifying property)	$1.80/ft²		$0.60/ft²	$0.60/ft²	$0.60/ft²	$0.60/ft² times applicable percentage**

Discuss The Cost of Waiting

- Cost of Waiting - Urgency
  - Utility funding
  - Continue overspending on energy
  - Continue overspending on human capital
  - Equipment nearing EOL
- Listen to Stakeholder Objections
- Buy in from stakeholders



Stakeholder Objection

Counter Suggestion

- **"I don't have any budget for an upgrade"**
  - Consider existing cost for system and equipment maintenance
  - Discuss the cost of waiting
  - Demonstrate lifetime economics
  - Highlight NEBs to different stakeholders
  - Divide project into smaller phases
  - Project will set both an economic and technical infrastructure for additional value-add building projects
- **"I Just want the cheapest option"**
  - Provide at least 2 options: A cost-based option and a value-added benefit option for the building

Pause for *Final* Questions

And now – a few words from LDL

Upcoming LDL Online Events

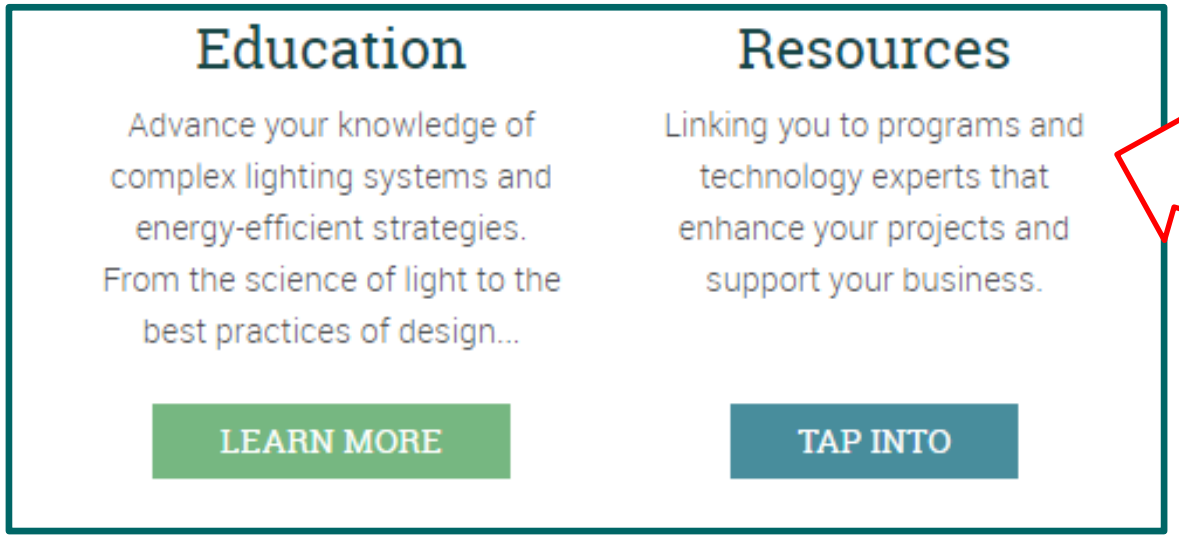
LDL Course	Delivery Date	Time
Fundamentals of NLC (Side A – Theory & Technology)	July 14	10:00 - Noon
Fundamentals of NLC (Side B – Practical Application)	July 15	10:00 - Noon
The Lighting Design Process	July 28	10:00 - Noon
Audit and Retrofit Techniques	August 11	10:00 - Noon
Introduction to Codes and Standards	August 25	10:00 – Noon

Today's slide deck and previous online courses can be found on our website

Click – Call – Connect

- Armando Berdiel Chavez
  - 206-475-2722
  - armando.berdiel@gmail.com

Visit us online



OR

Email Us

lightingdesignlab@seattle.gov

Todays slide deck will be posted here!

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Please take the online survey once you exit the webinar

We'll *SEE* you on the next call… ☺

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