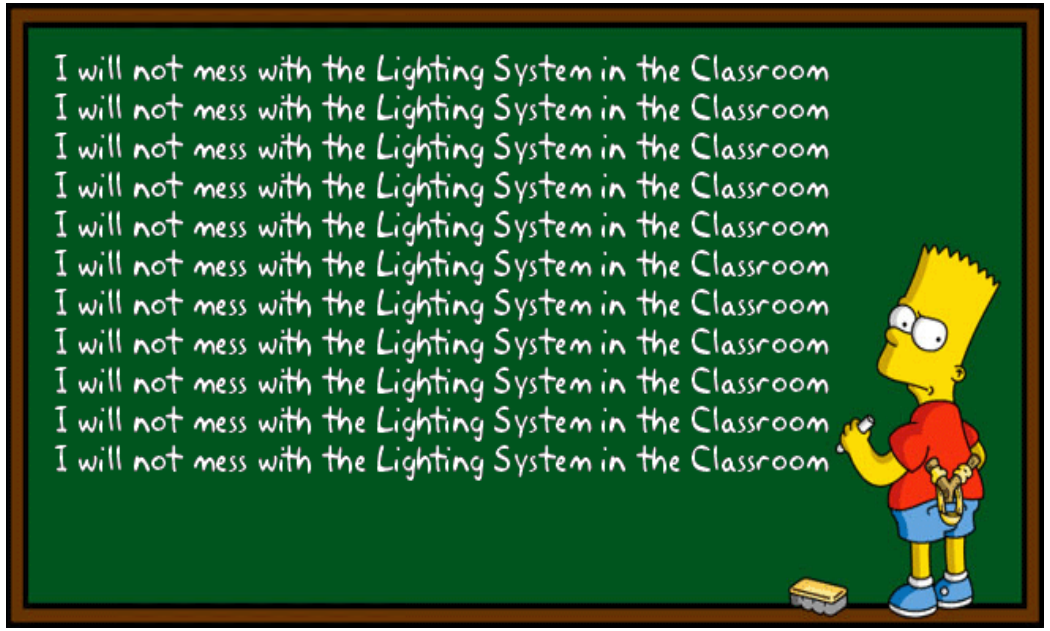
Jump Starting Networked Lighting Controls Projects in Schools (NLC in Schools!)

Presented by

Armando Berdiel Chavez, LC, M.Eng.

Technical Development Supervisor

December 8th, 2020



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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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BETTERBRICKS

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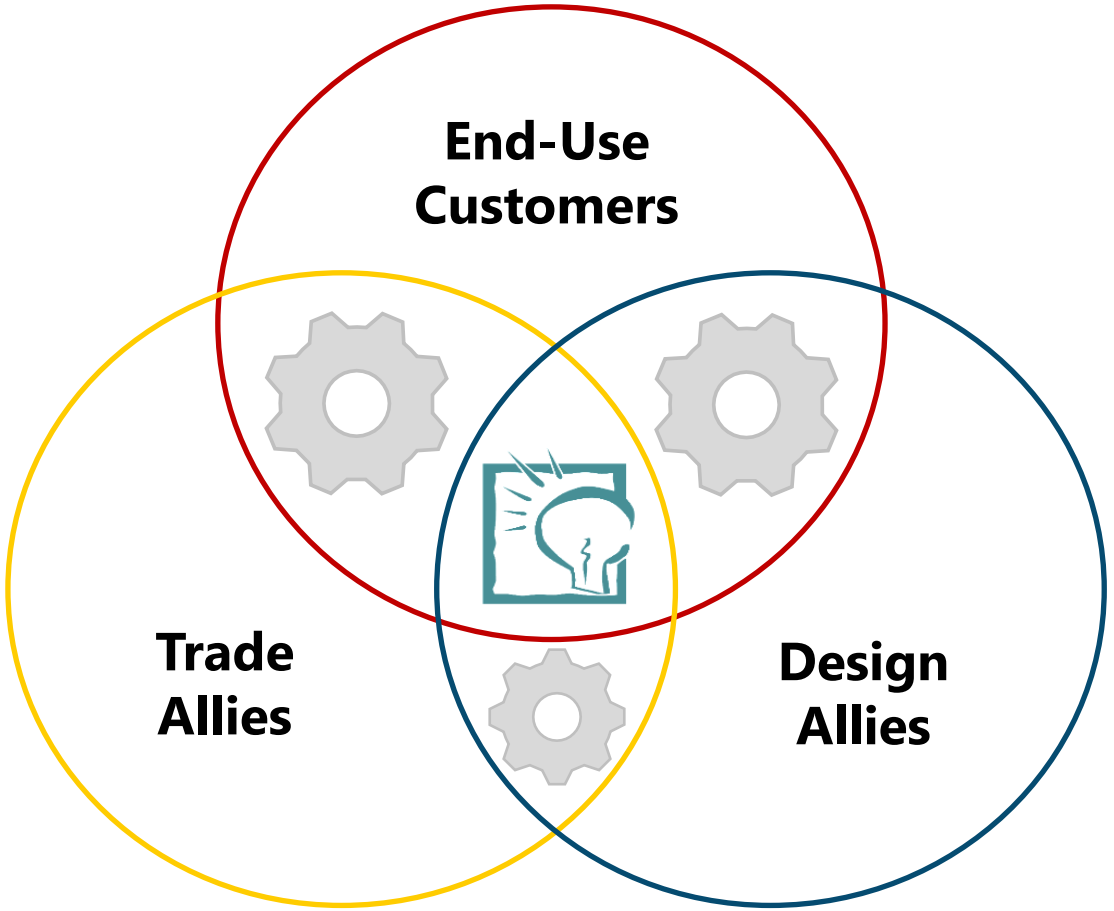
We'd like to thank today's event sponsor

Who We Work With

It takes a village…



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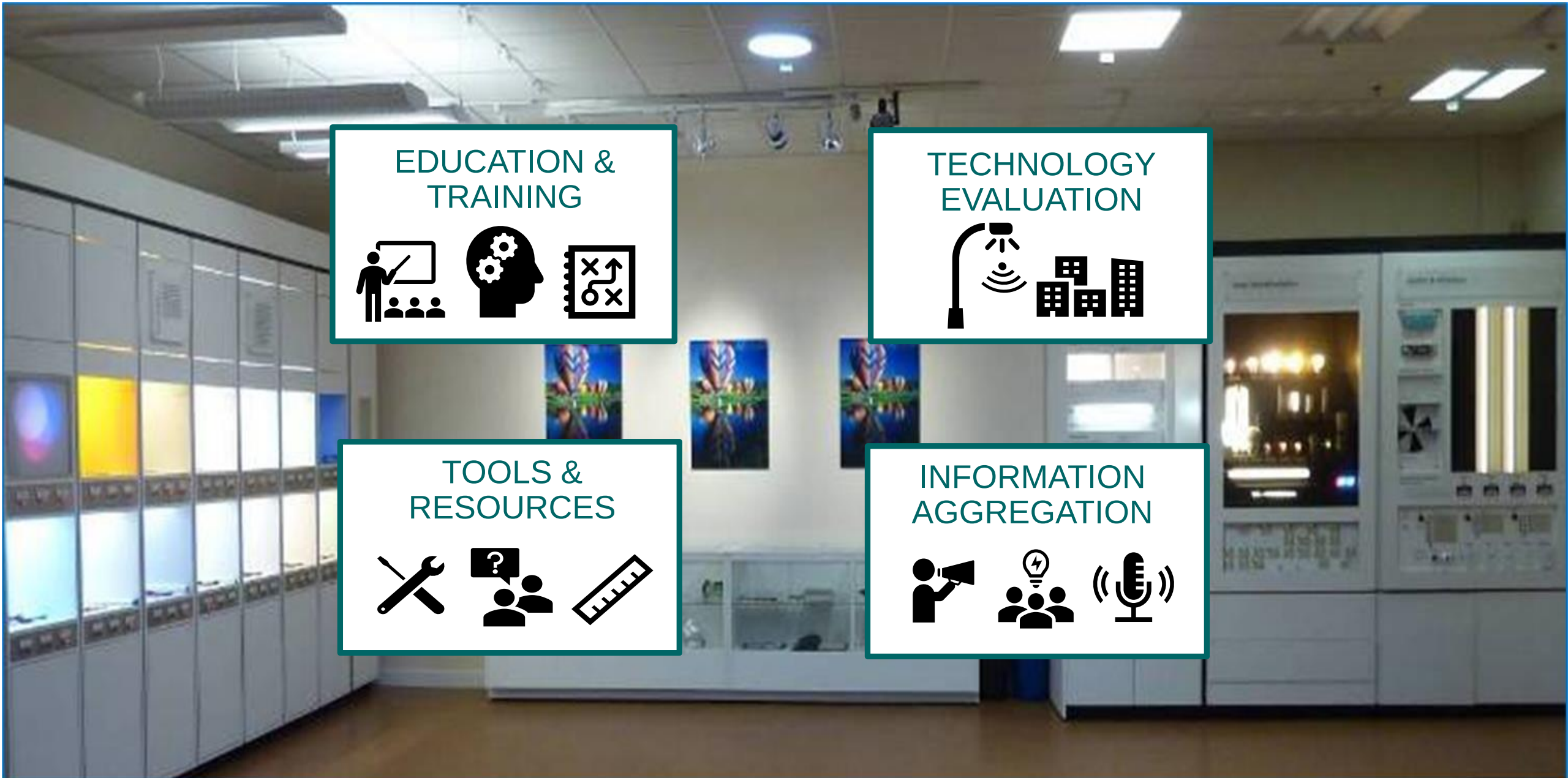
LDL's Four Core Service Areas



Quick 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 (Commercial & Resi)
  - Sr. Project Coordinator – Commercial Inside Sales (Spec to Close)
- Pearl Street LED Systems (NJ, NY, PA)
  - Controls & Project Development Engineer (Retrofit Market)

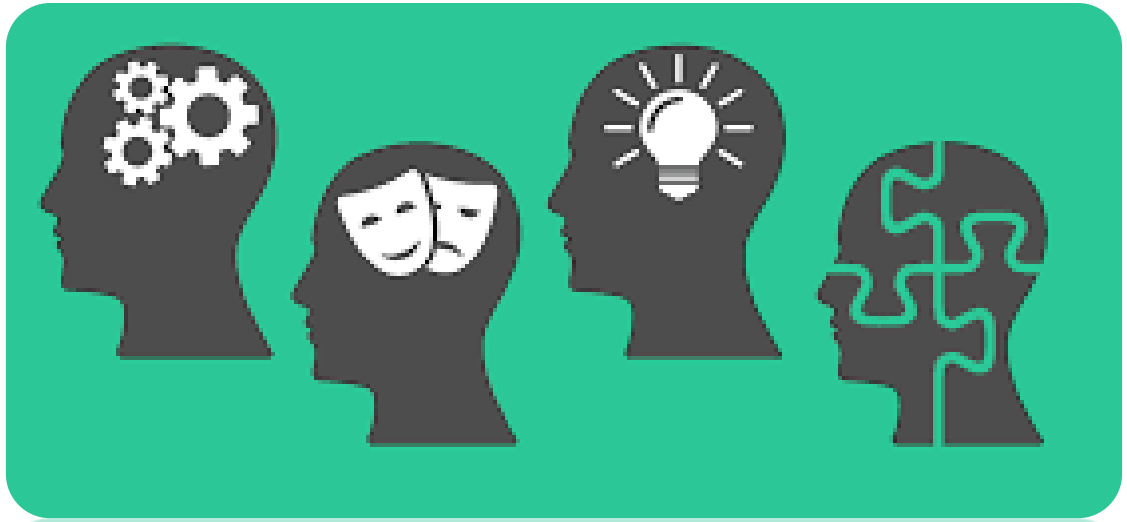
Learning Objectives

- Understand and apply NLC hardware and features
- Gain knowledge to ask the right questions to implement common control strategies in schools
- Leverage utility resources
- Navigate financial & operational conversations for NLC projects

Time for a Quick Poll…

Enough about me…

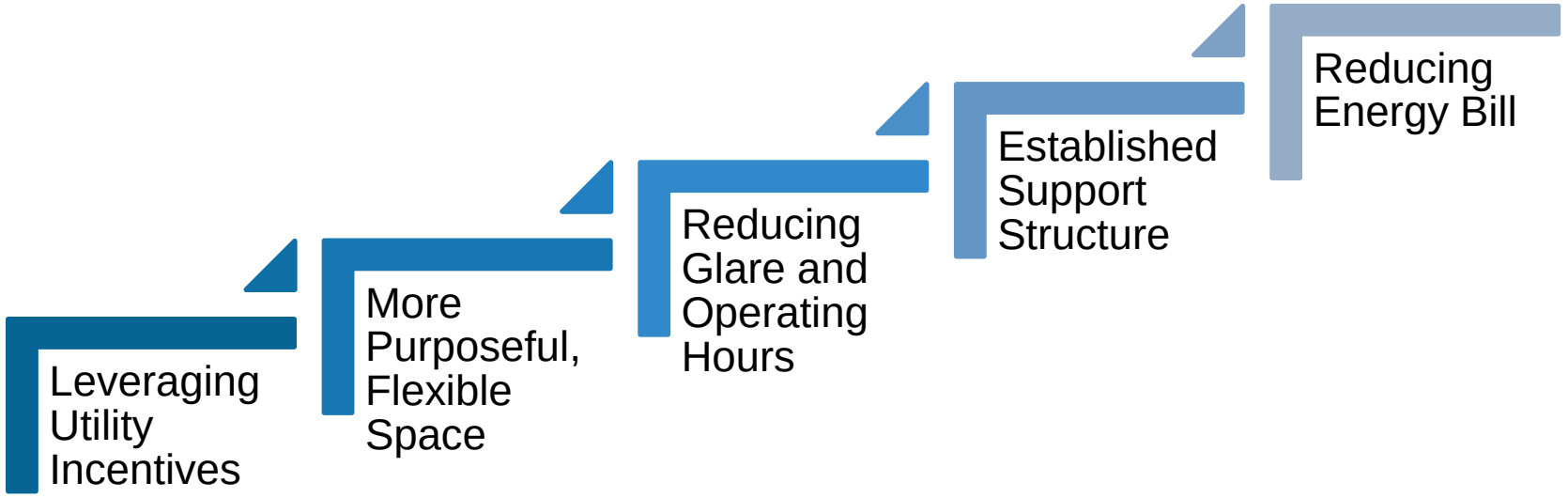
Let’s talk about you…



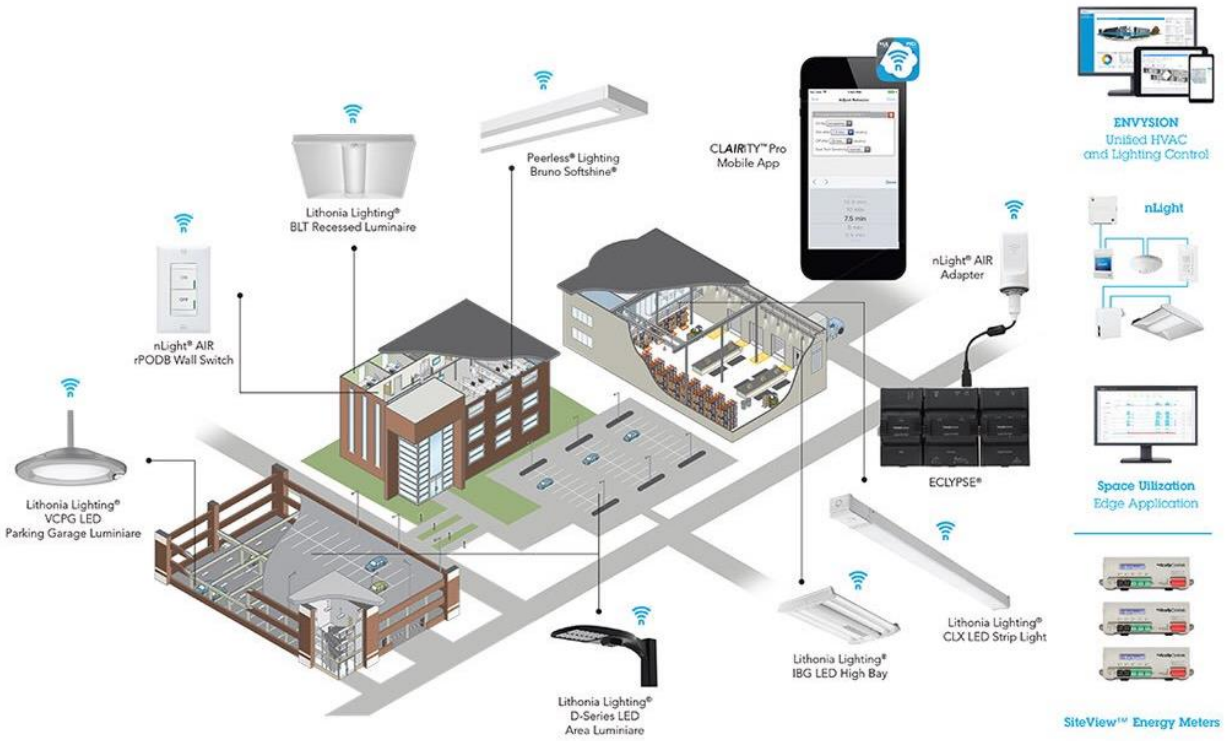
The Why

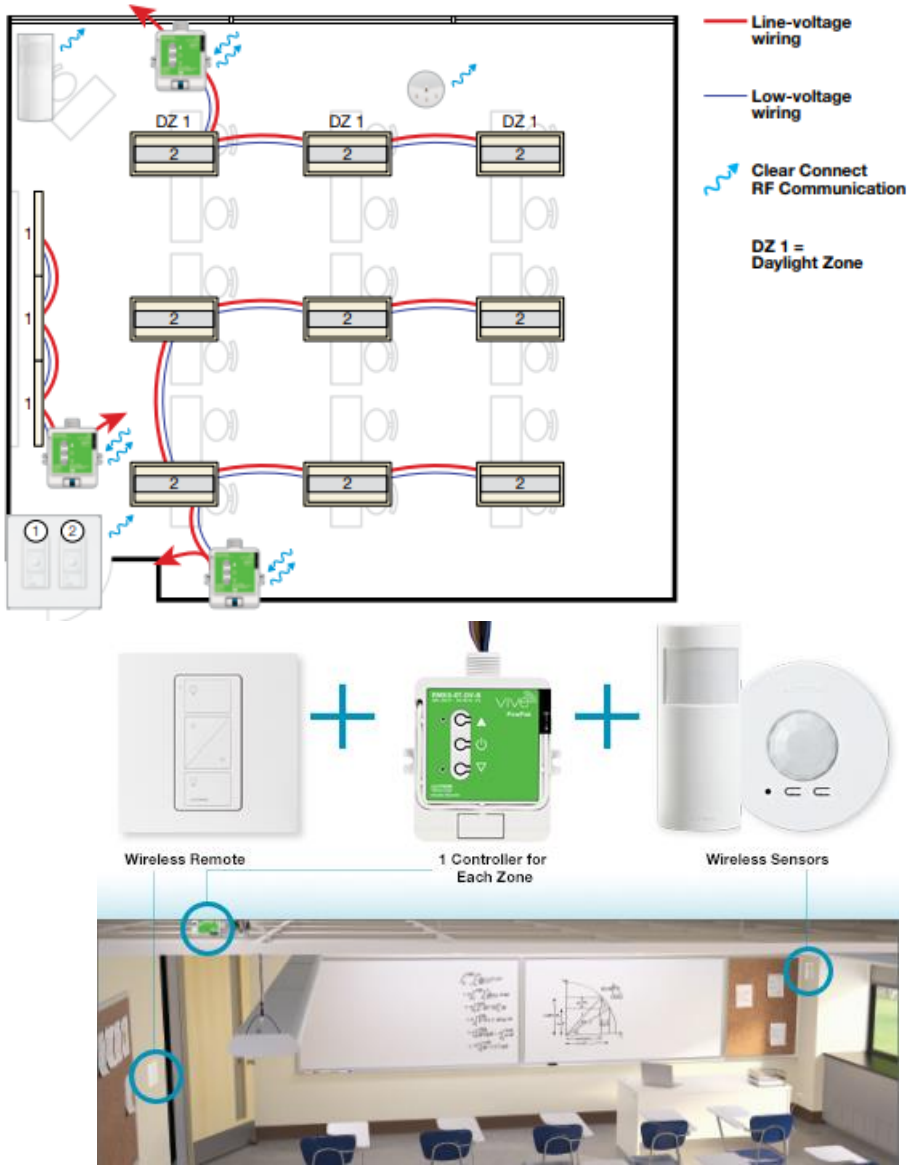
- Those smiles
- Some good ol’ Learnin!
- Improving quality of life
- Enhancing the purpose of the space

The How


Leveraging Utility Incentives
More Purposeful, Flexible Space
Reducing Glare and Operating Hours
Established Support Structure
Reducing Energy Bill

The What





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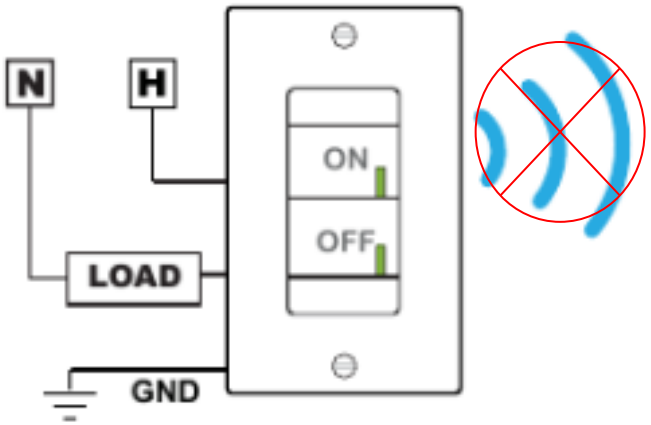
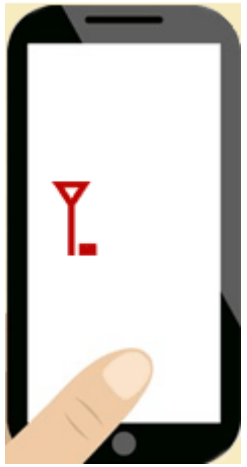
The Odds Have Been Stacked Against NLC

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

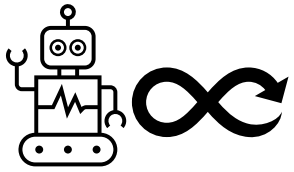




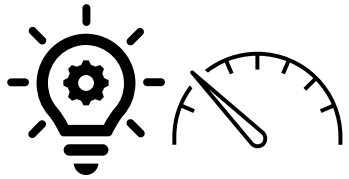
NLCs Today are Smoother and Leverage NEBs

Even though there is still a long way to go…

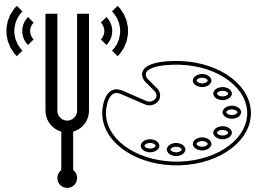
The Proliferation of *FEATURES*…



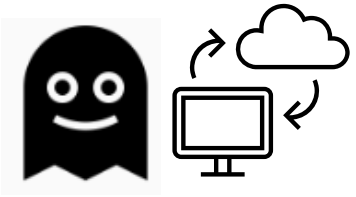
Controls Persistence



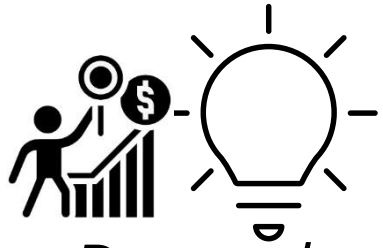
Energy monitoring



Color tuning



Cyber security



Demand Response

… and so many more

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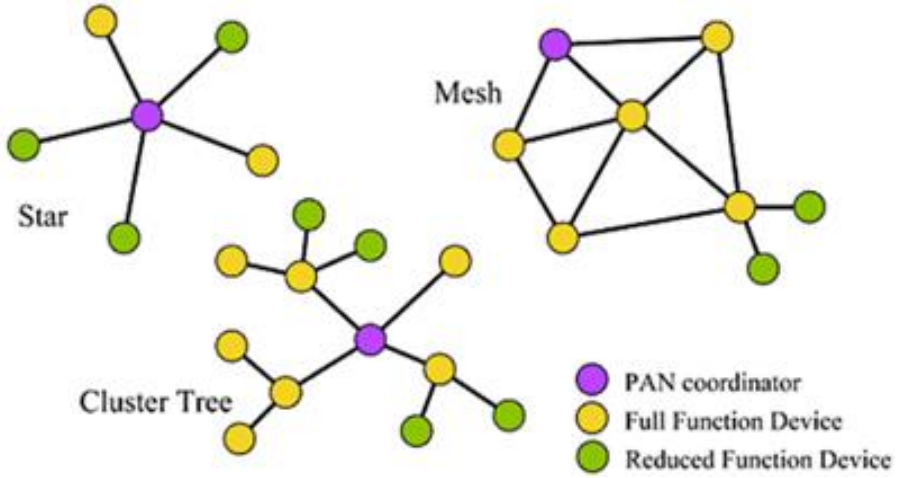
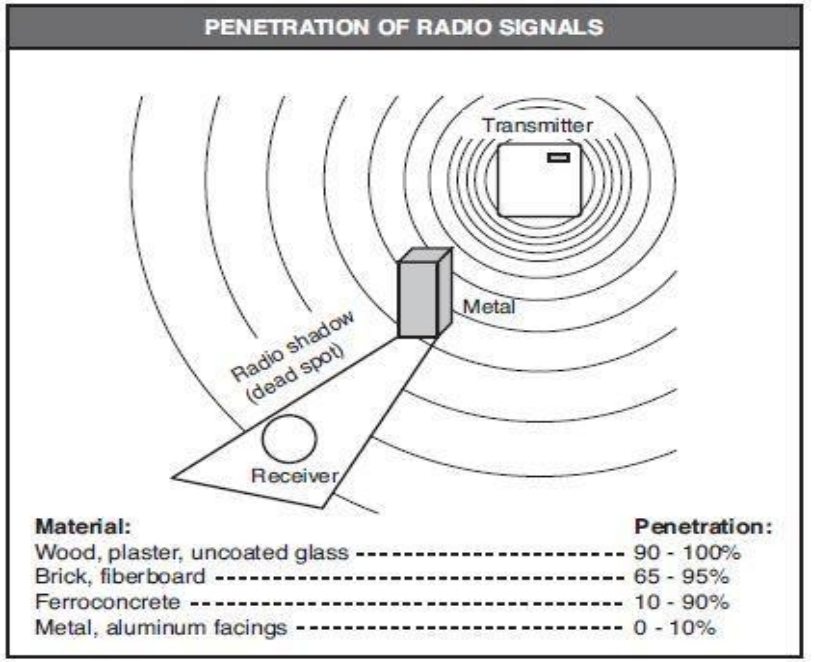
Wireless Protocols with NLC Today

- Zigbee
- Bluetooth
- BLE
- Enocean
- Zwave
- WiFi
- IEEE 802
- Proprietary
- Others





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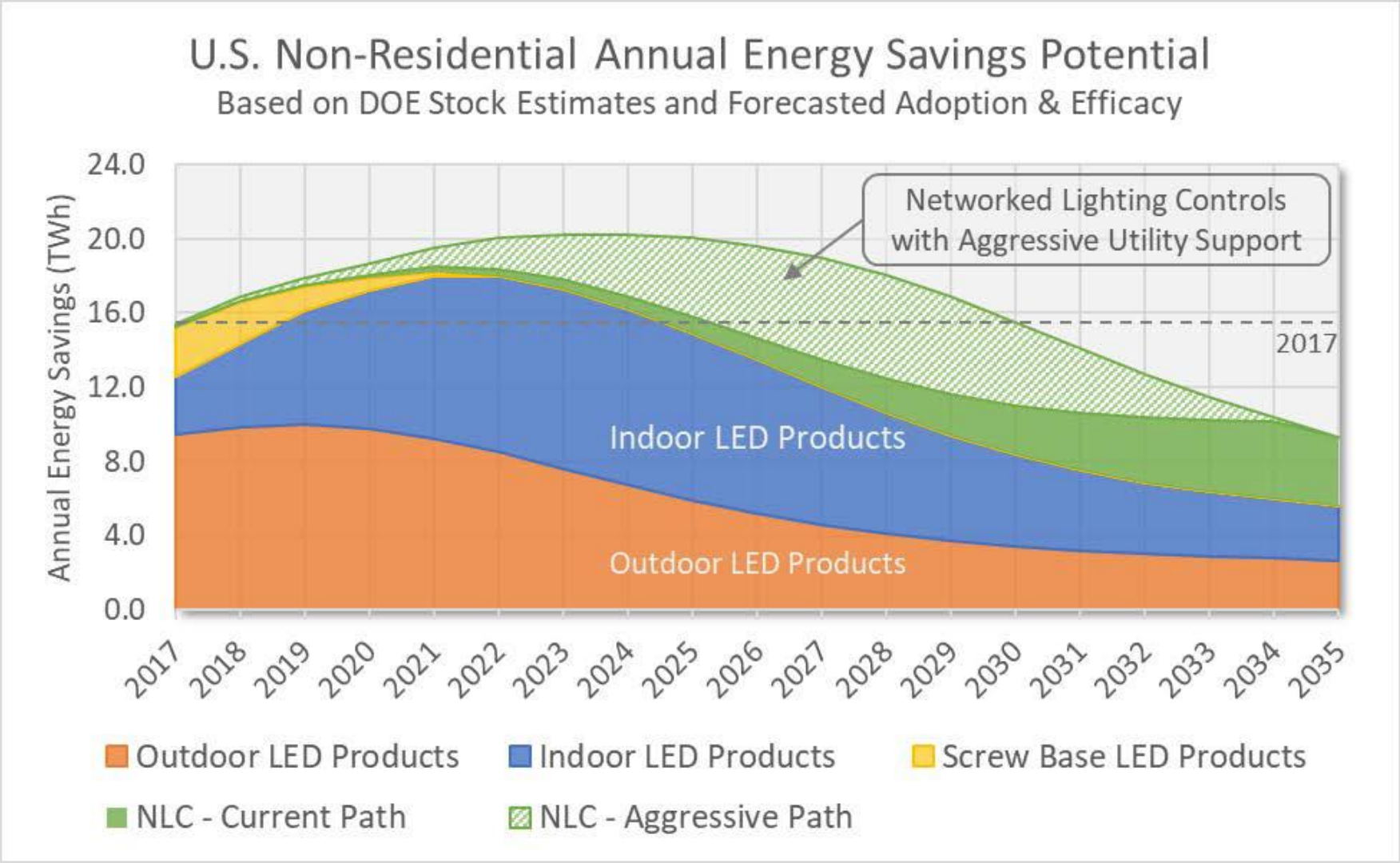
The Savings Prospects



ENERGY SAVINGS POTENTIAL OF DLC COMMERICAL LIGHTING AND NETWORKED LIGHTING CONTROLS

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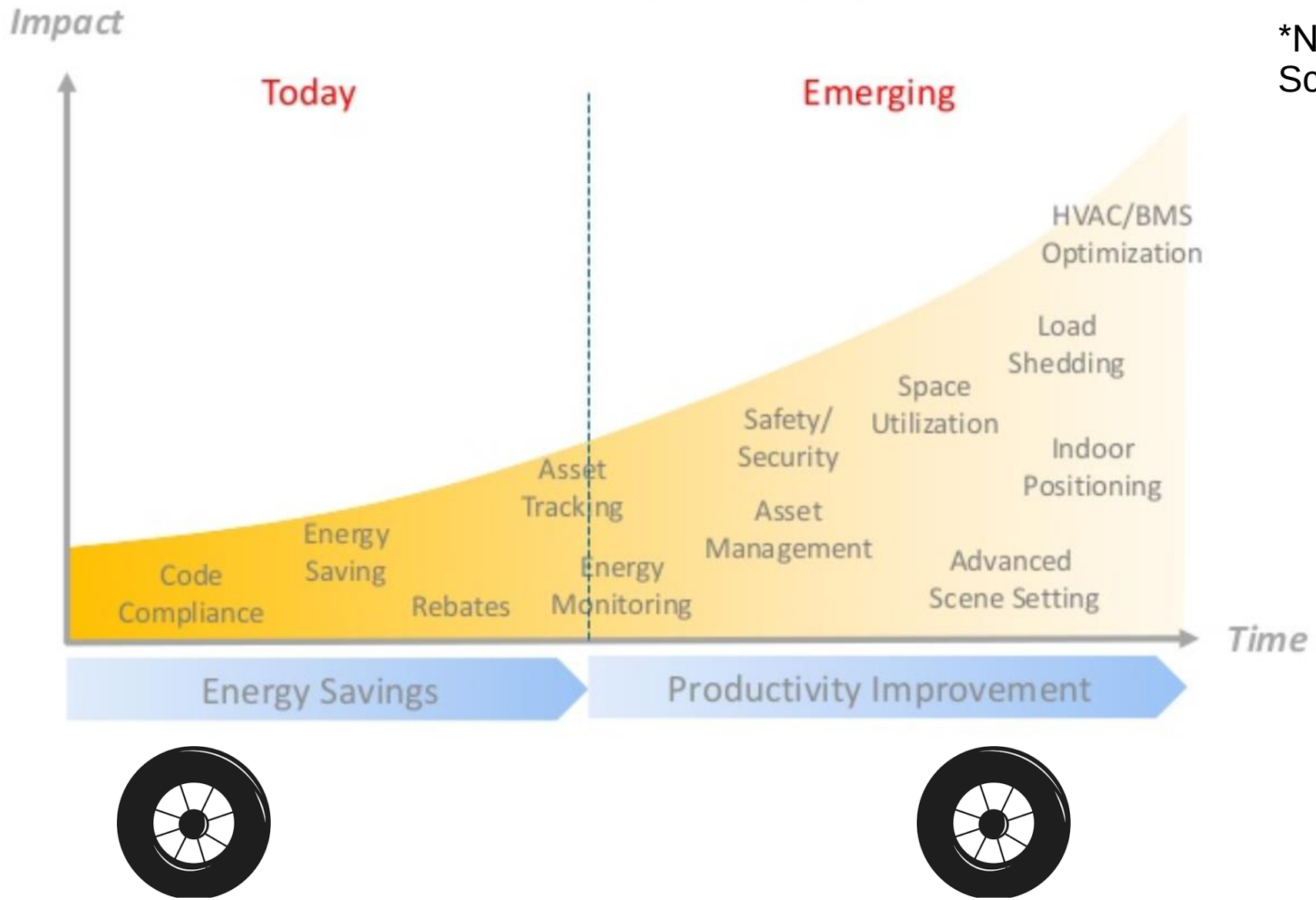
Emerging Tech Non-Energy Benefit Drivers



Not in Today's Scope

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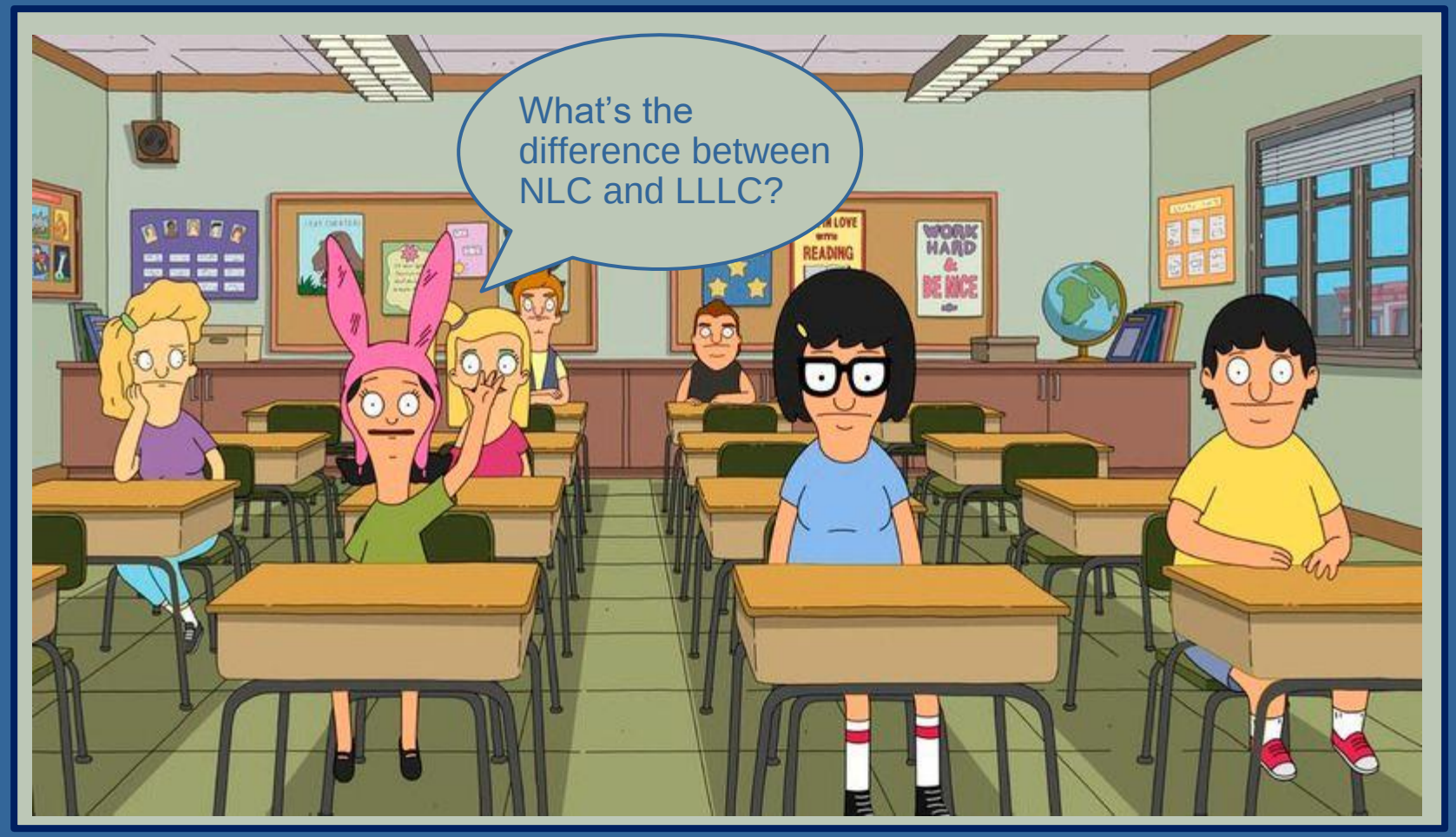
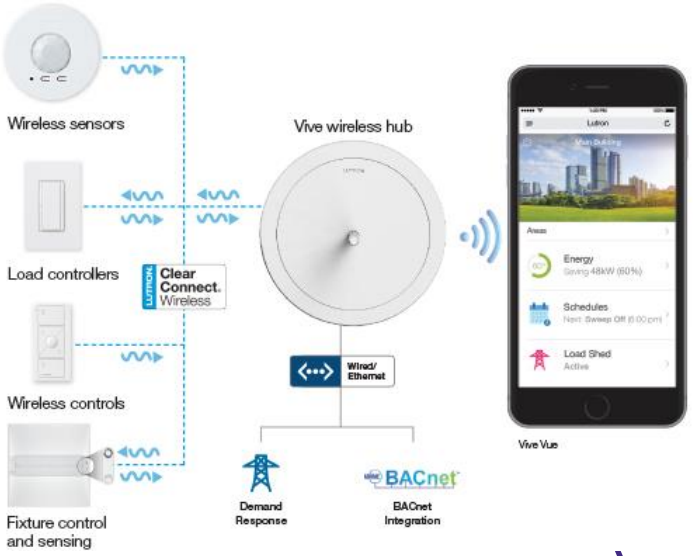
NLC Terms, Control Strategies, and Other Fun Stuff



TomAto – TomAto

- Advanced Lighting Controls
- Networked Lighting Controls



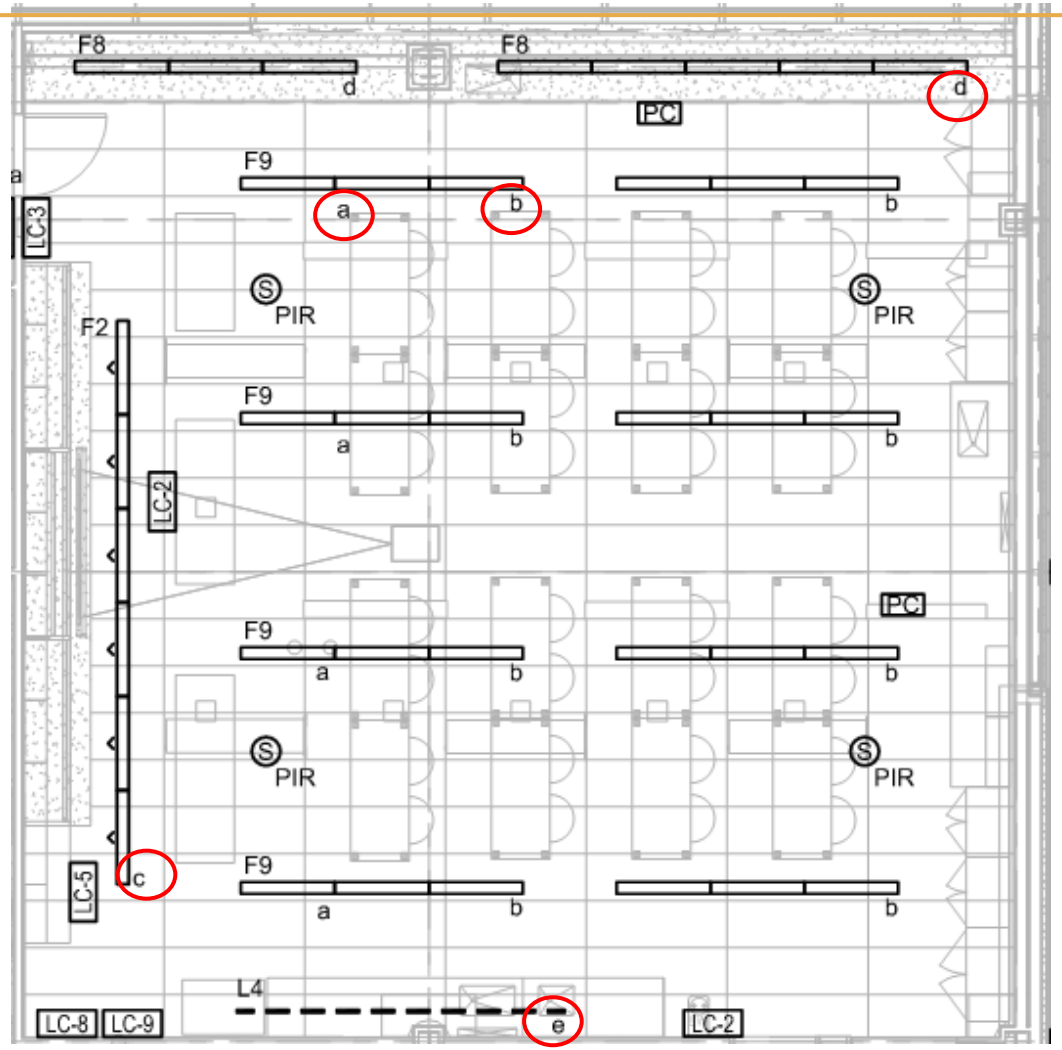
→ ALC = NLC

LLLC

→ Think about the sensor switch, or analog motion sensor with a relay.

Control Zone / Channel

- A Control Zone is a logical grouping of luminaires that are controlled together.
- Generally, the more control zones, the more flexible the system will be.
- Poor zoning is the most common error in controls.



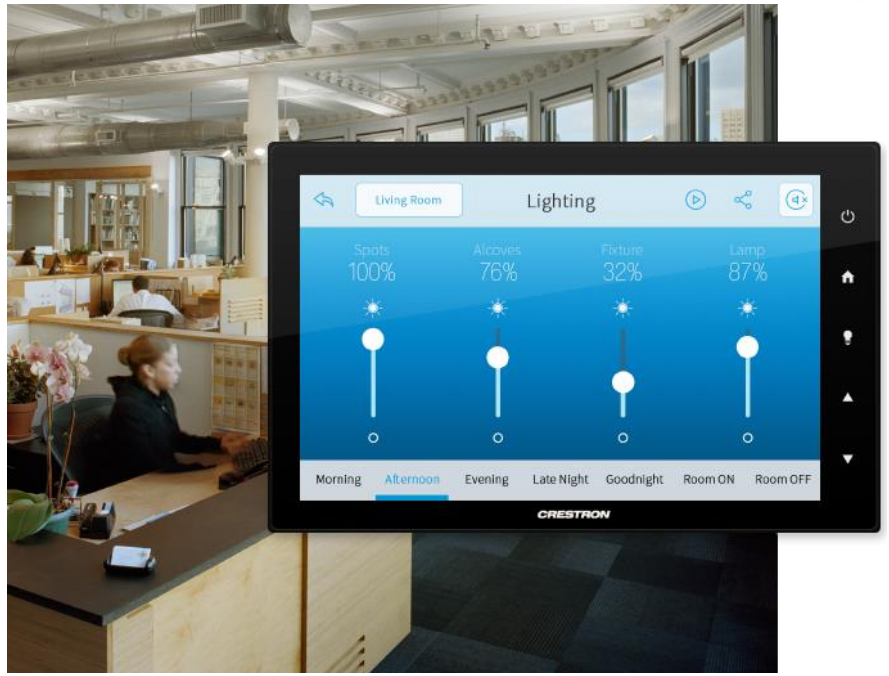
North Seattle College Allied Health Building

Load Controllers

- Controls a Zone of Lighting
- Dimming or Relay
- 1A-20A
- Usually 0-10V Flavors for dimming

Zone Controller / Wall Station

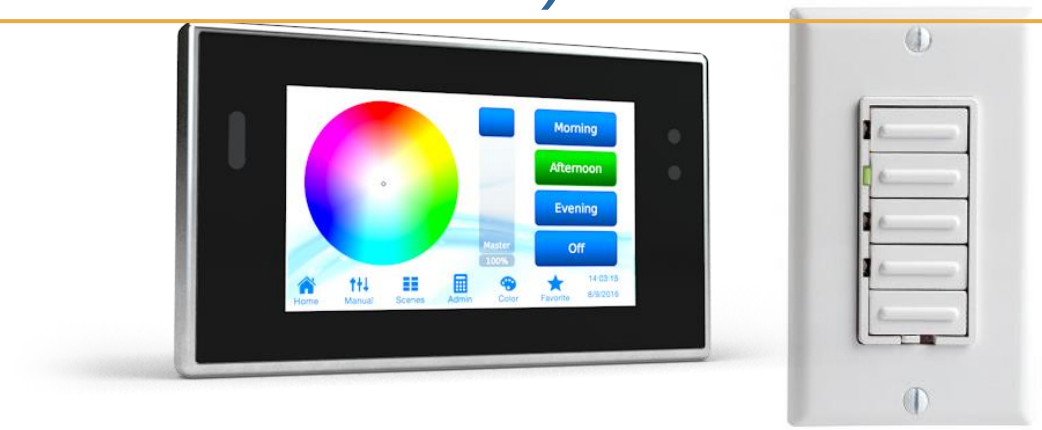
- Line voltage
- Low voltage remote dimming
- Networked System
- Zones or groups
- Simple to design
- Easy to understand
- Users like personal control



Courtesy: Lutron, Leviton, Crestron

Scene / Preset Control (More Complex Wall Station)

- Grouping of zones at specific levels
- More complicated
- Simply Repeatable
- May be confusing
- Consider engraving



Courtesy: Lutron, Leviton, Pharos

High End Trim or Task Tuning

IES Lighting Level Guidelines

IES Lighting Level Guidelines	Average Maintained Footcandles (Horiz)	Location (AFF = Above finished Floor)
Bank		
ATM - walk up (indoor)	20 fc	at 3' AFF
Lobby	10 fc	at 0' AFF
Teller Window/Writing Table	30 fc	at 0' AFF/Writing Surface
Bar		
General Seating	5 fc	at 2' AFF
Lounge/Work Surfaces	10 fc	at 2' AFF or work surface
Corporate Office		
Workspace	30 fc	at 2.5' AFF
Dining (Non-Hospitality)		
Cafeteria	15 fc	at Tabletop
Coffee Shop	10 fc	at Tabletop
Library		
Stacks	20 fc	at 0' AFF
Reading	50 fc	at 2.5' AFF
General	15 fc	at 2.5' AFF
Reading & Writing		
Graphite Pencil	30 fc	at 2.5' AFF
Red Pencil	50 fc	at 2.5' AFF
Black Pen	30 fc	at 2.5' AFF
Other Pen	40 fc	at 2.5' AFF

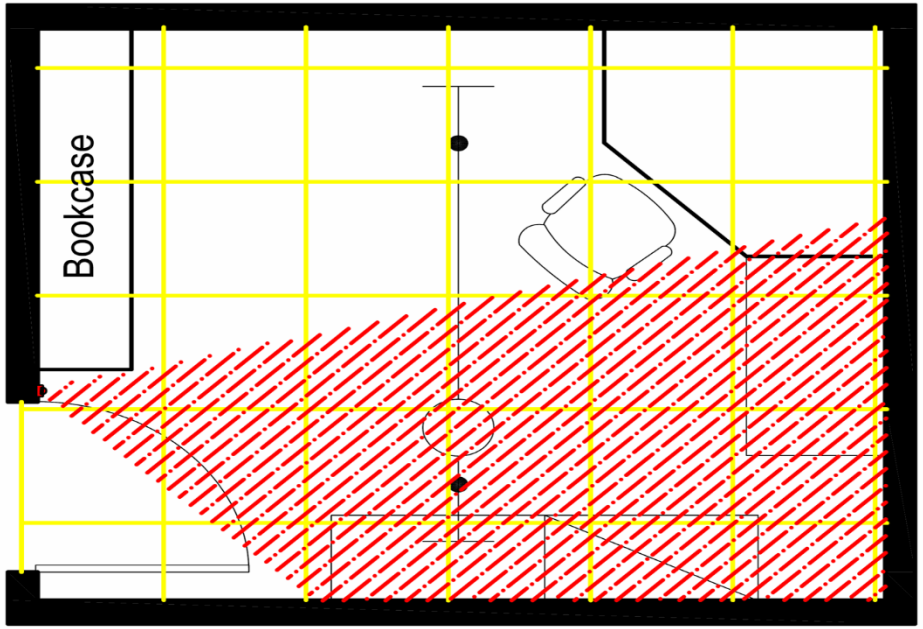
Lighting professionals specify conservative lumen packages

- Deliver the target illuminance level
- Reduce glare
- Extend the Life of the fixture
- Save as much as 20-30% of the energy in a typical system

Motion Sensors -

Occupancy and Vacancy

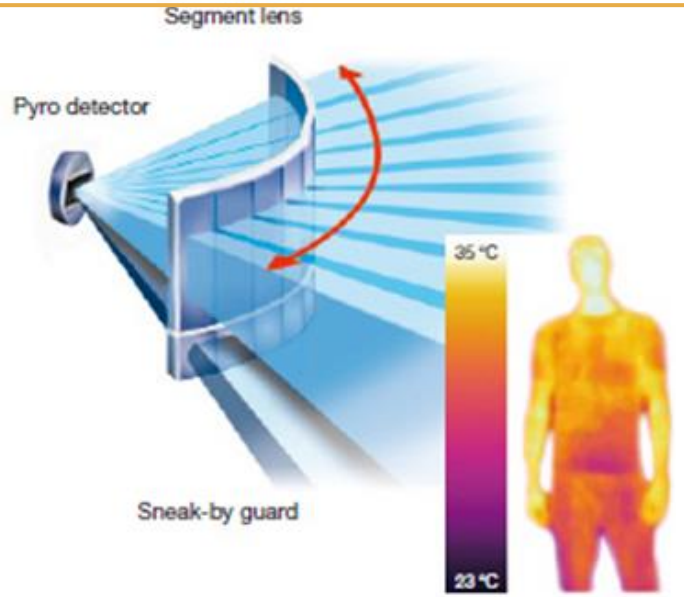
- Auto on
- Auto off
- May control load
- Mounting
  - Wall
  - Ceiling
  - Fixture
- May have some residual angst over older systems

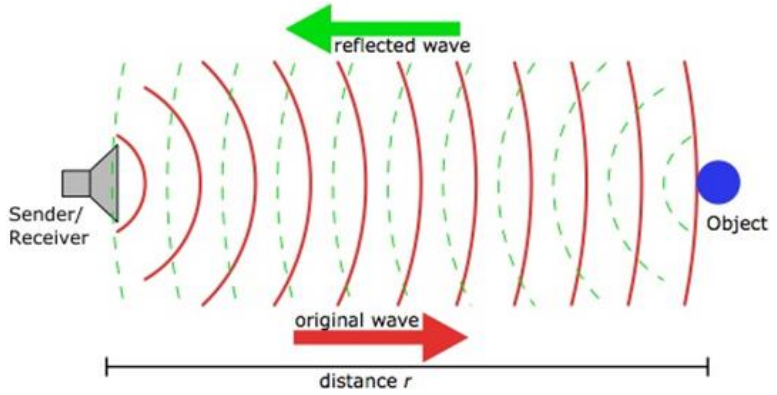


b

Sensor Types

- Passive Infrared
  - Needs line of sight to work
  - Can be wireless -> battery
- Ultrasonic
  - Does not need line of sight to function
  - Only wired -> constant power
- Dual Tech
  - Little bit of both

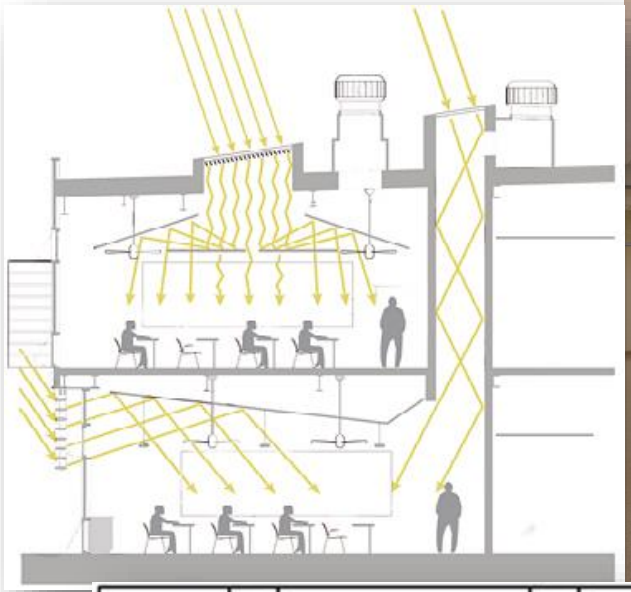




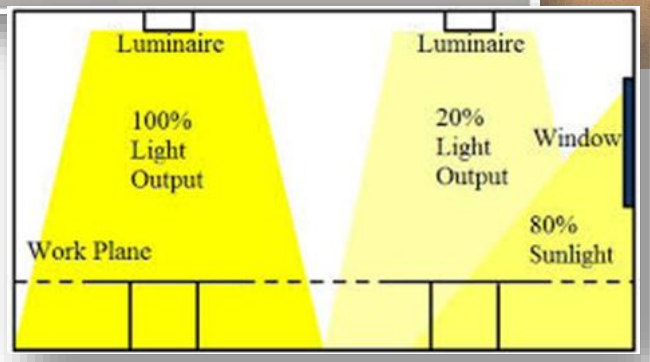
Courtesy: Wattstopper, Echoflex, Leviton, Steinel

Daylight Harvesting

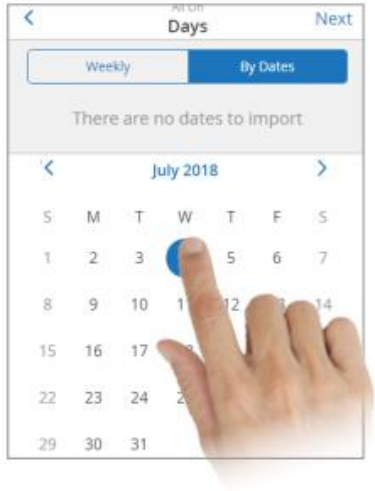
- Leverage available daylight availability
- Dim artificial Light
  - Comfort in maintaining appropriate light level
  - Reduce Glare
  - Save Energy
- Commissioning
  - Pair with motion sensors
  - Rows
  - Calibration

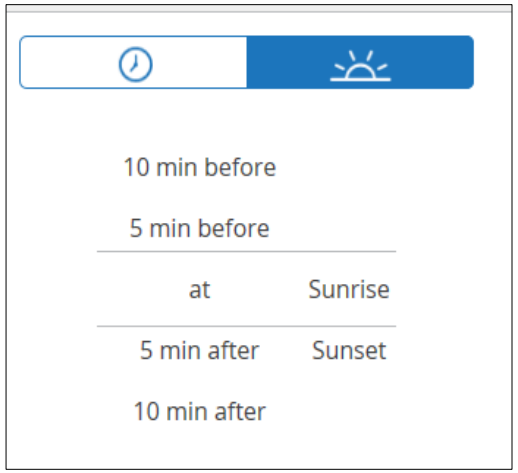


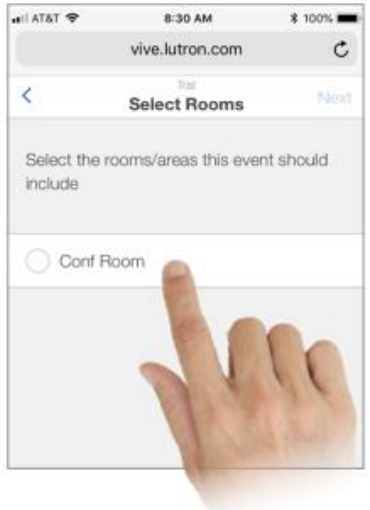
Chemeketa Community College Health Sciences Building
SRG

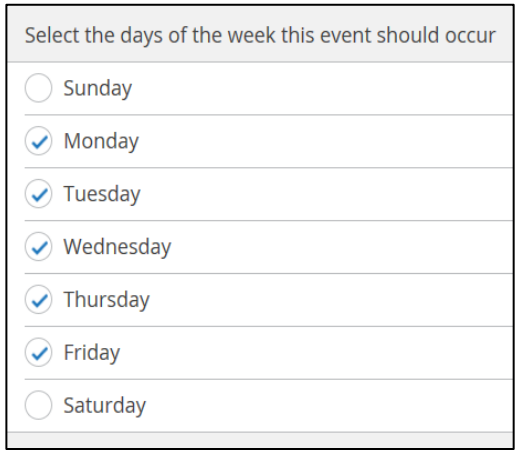


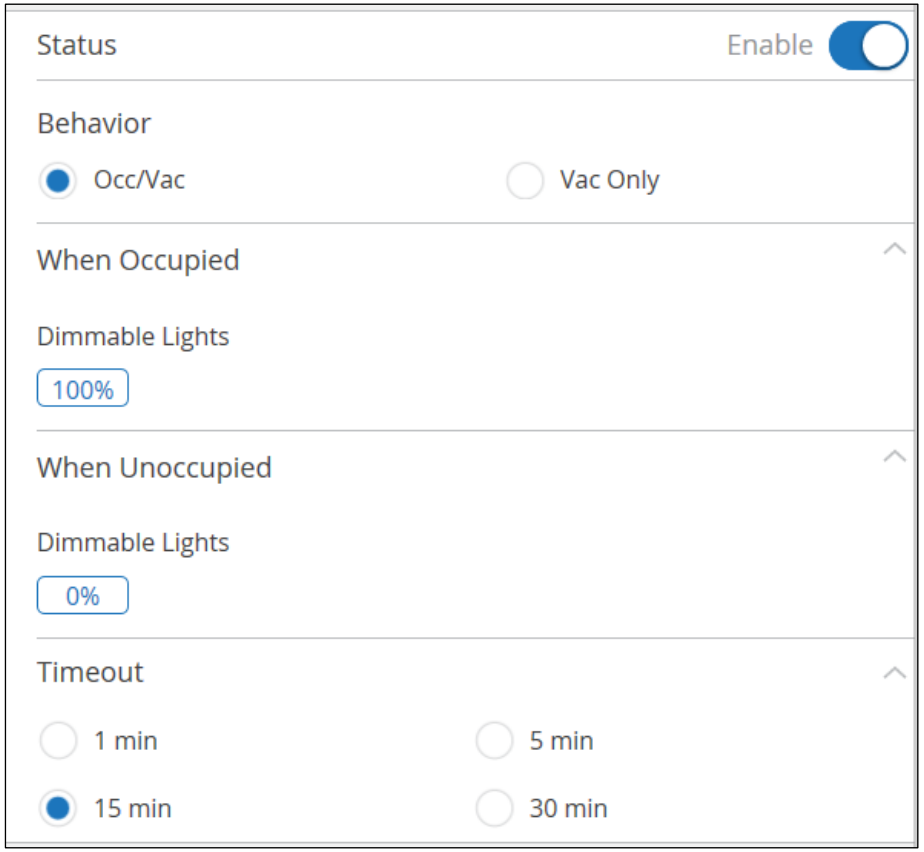
Timeclock Programming











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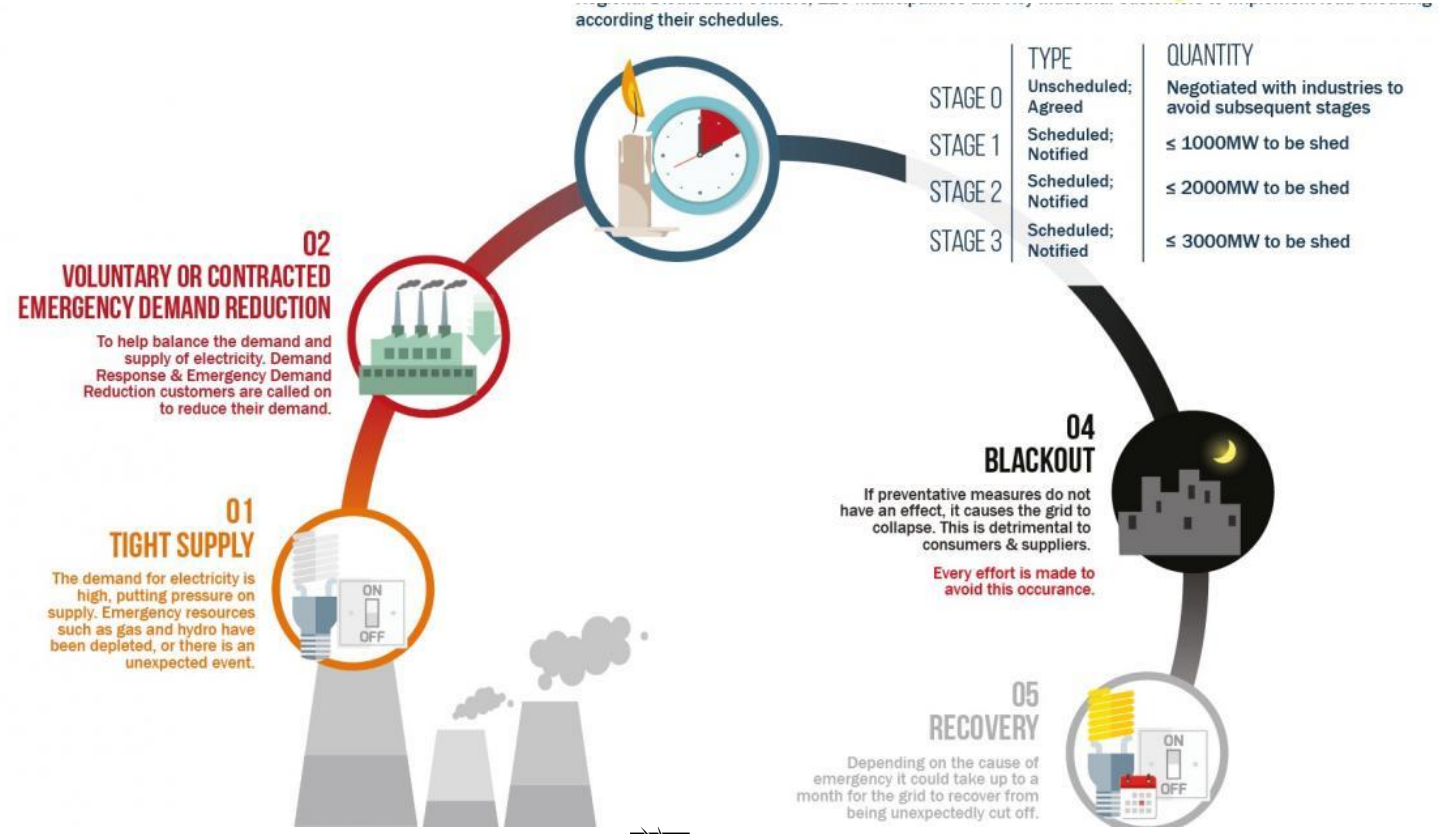
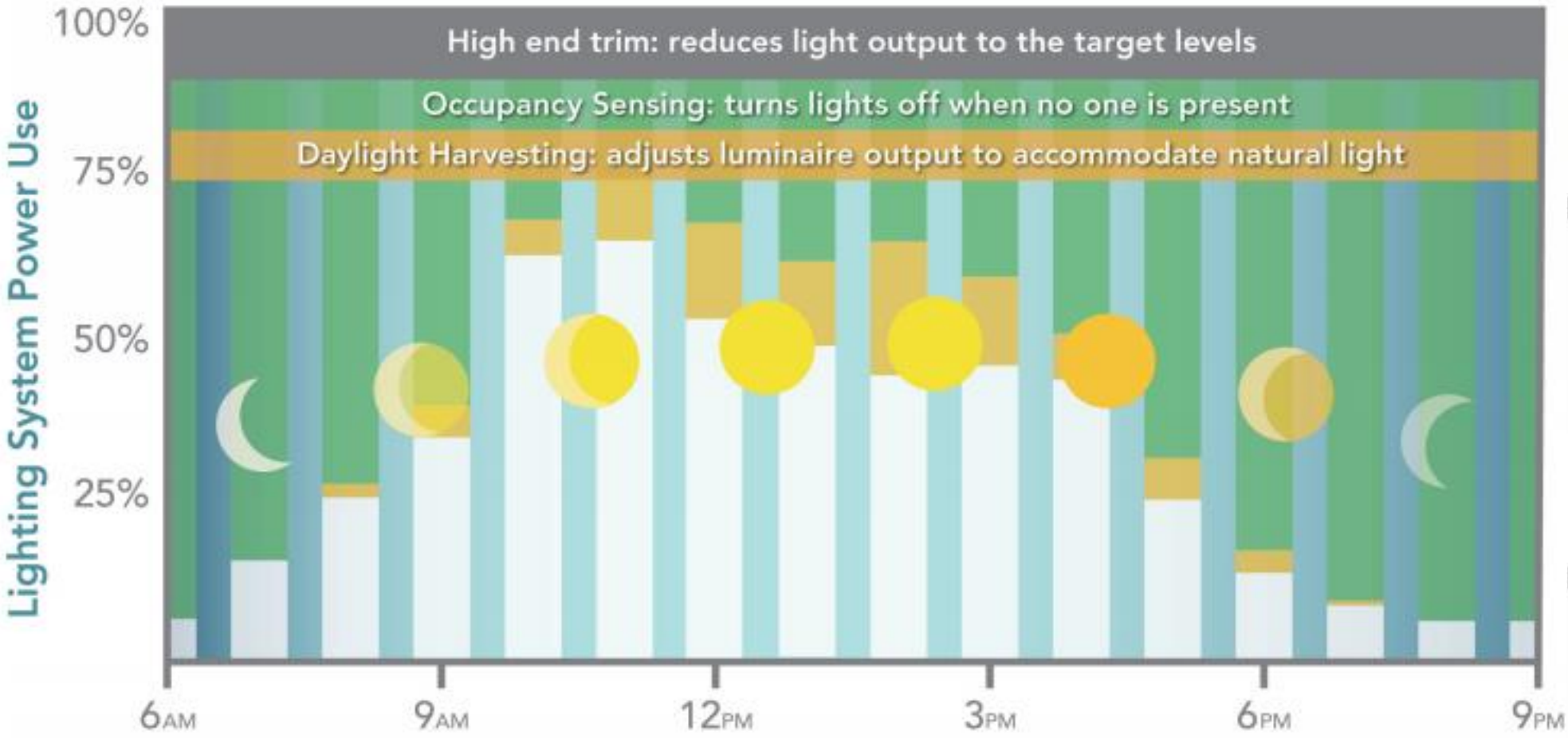
Load Shed / Demand Response

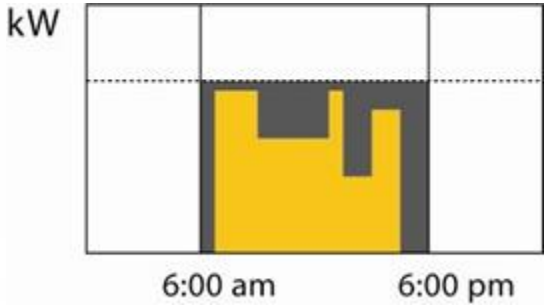
- The ability to reduce lighting load by a set amount when signaled to do so by others.
- Most NLC Systems have a DR/ADR setting



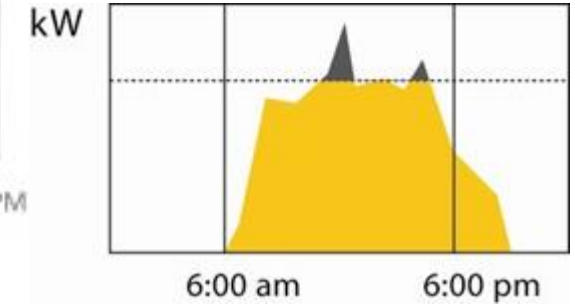
Critical NLC Strategies Compounded



Personal Control



Demand Response



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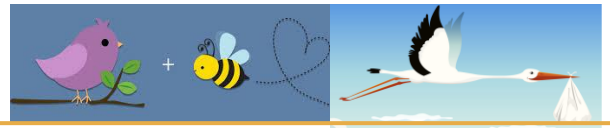
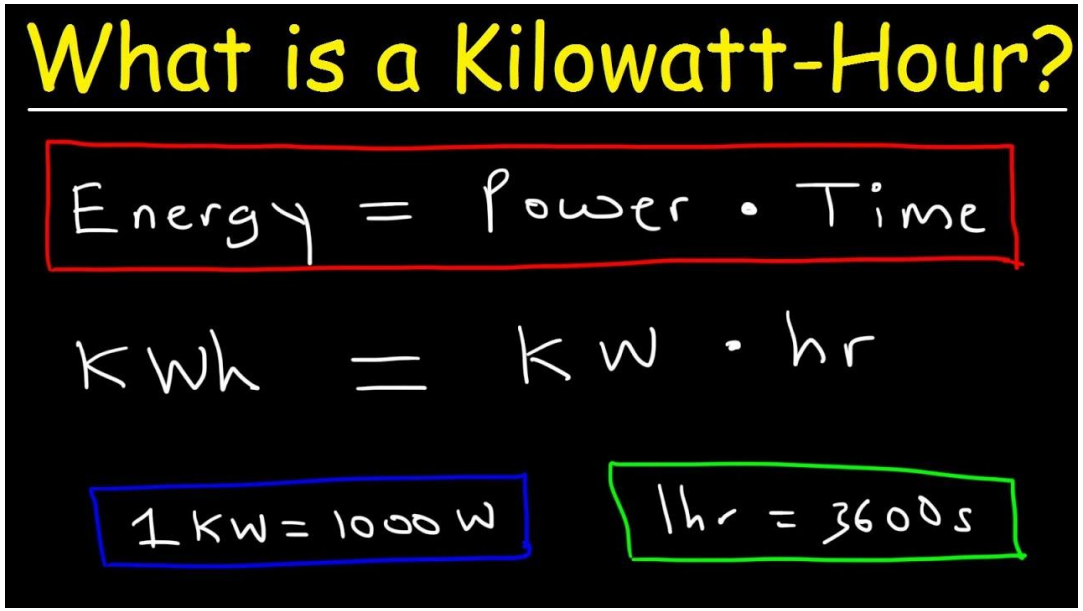
Where do Savings Come From?



- Converting to LEDs
  - Reduces Wattage
  - About 50%-75% reduction
- Adding NLC/LLLC Systems
  - Reduces Operating Hours
  - 8760 hours in a year
  - About 50%-75% reduction



Medium General Service Downtown Network (MDD)

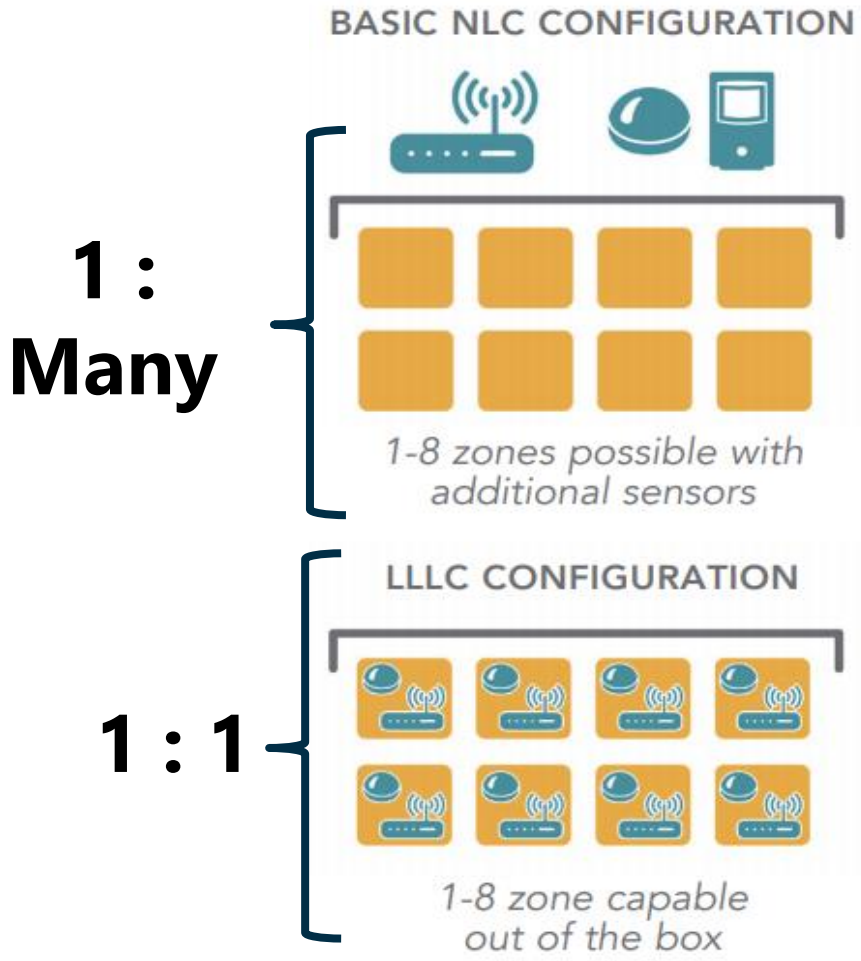
	Jan 2019	Nov 2019	Jan 2020
Per kWh	$ 0.0925	$ 0.0919	$ 0.0987

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

NLC

LLLC



BONUS: Automatically Meets Code

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2018 Washington State & Seattle Comm Energy Code*

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with one of the following:

1. Lighting controls as specified in Sections C405.2.1 through C405.2.7.
2. *Luminaire level lighting controls (LLLC)* and lighting controls as specified in Sections C405.2.1, C405.2.3 and C405.2.5. The *LLLC luminaire* 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.
   - 2.3. For each control strategy, configuration and re-configuration of performance parameters including: bright and dim set points, timeouts, dimming fade rates, sensor sensitivity adjustments, and wireless zoning configuration.

2: Individually Addressable

2.1: Occupancy, Vacancy, Dimming

2.2: Daylight Harvesting, Dimming

2.3: Networkable

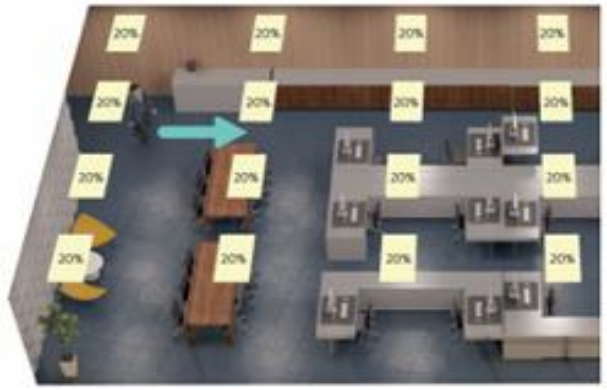
How These LLL Control Methods Work Together

At the room level – Open Office

7:00am

Initial walk-in

Lights on to background or daylight level



9:00am

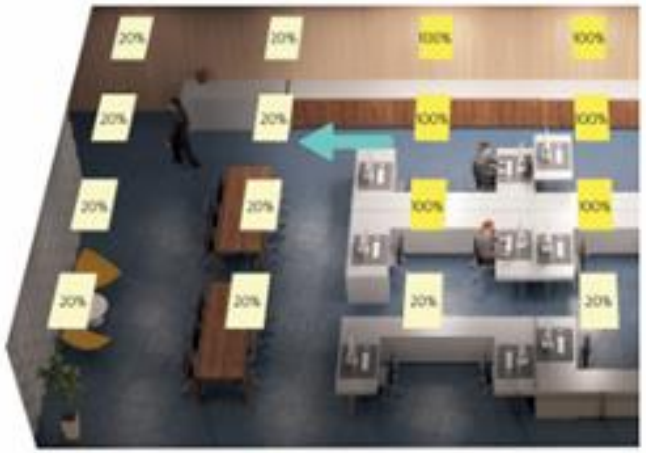
Half Occupied

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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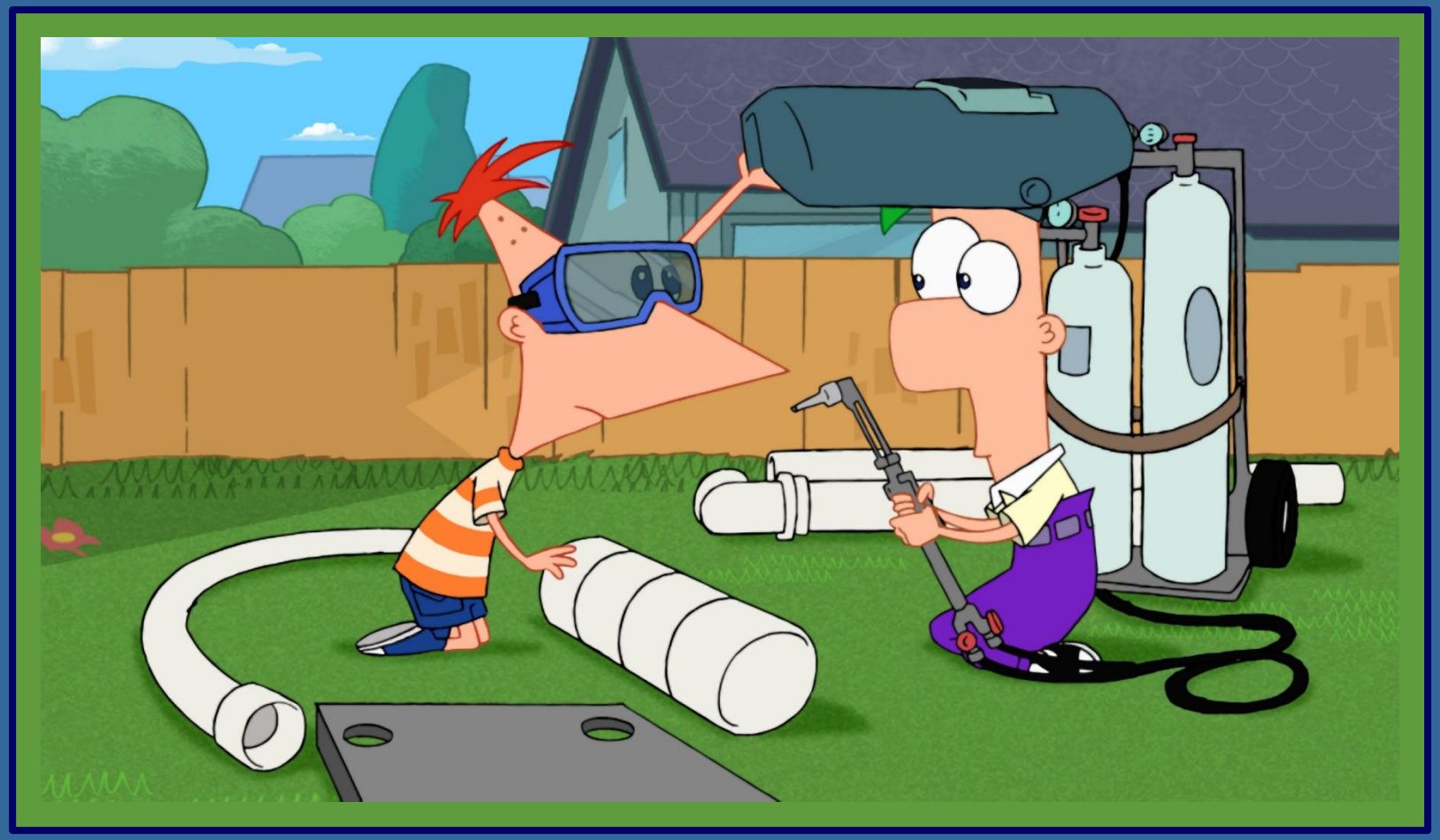
Poll: What is your take on LLLC Technology?

Pause for Questions

Before Getting These Project Started



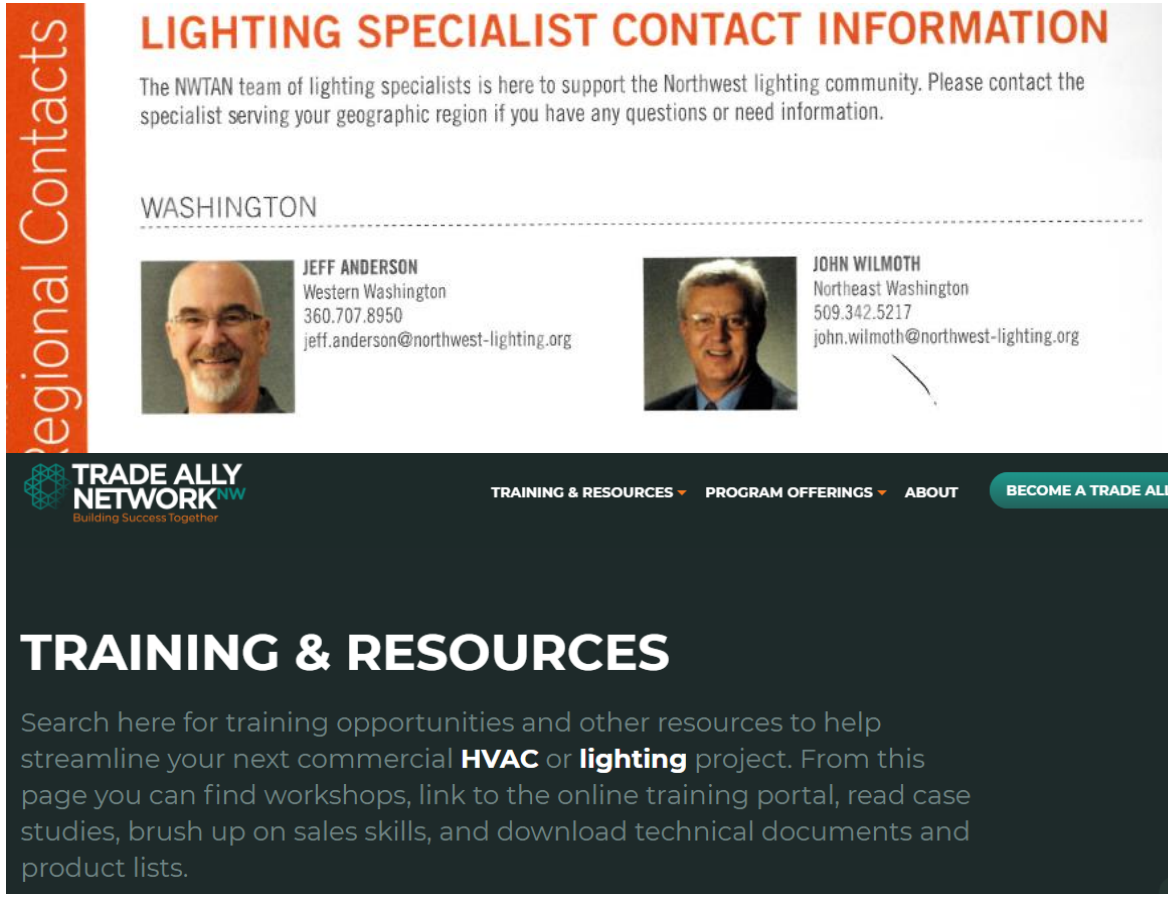
Relatively Nearby Regional Resources

- In field / Development Support:
  - SCL Energy Specific Questions:

Connect with an Energy Advisor to help you better understand energy options, navigate your choices, and create a plan that helps your home or business save energy and money. Conservation, energy efficiency and smart energy choices are within reach.

Call 206.684.3800
Email SCLEnergyAdvisor@seattle.gov

- Best Practices, Mockup, Tools, Resources, Network
  - Your Utility
  - Lighting Design Lab
  - Integrated Design Lab
  - Trade Ally Network NW
  - Many Others!



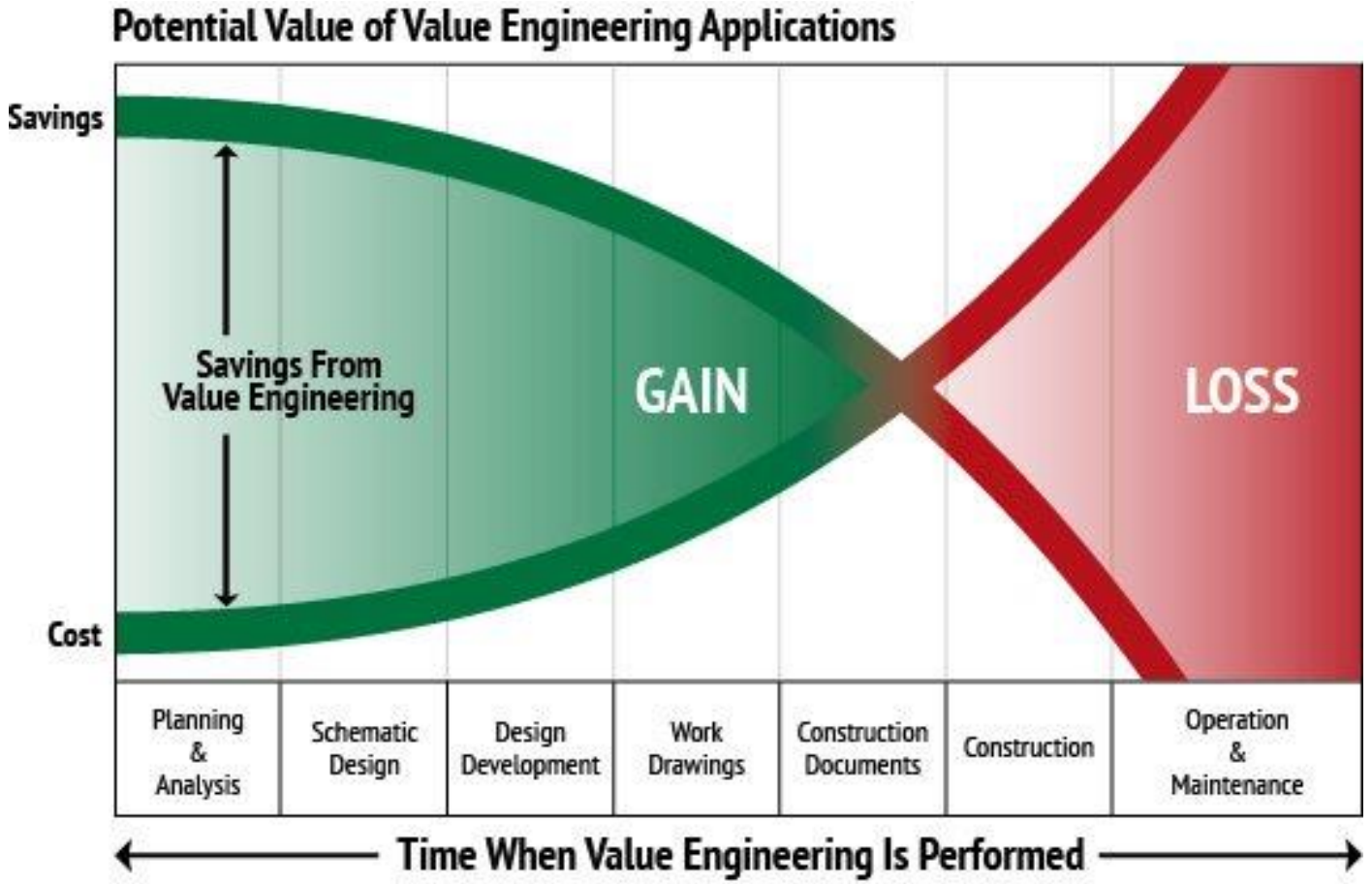
Lighting Audit: Make a First Impression

- 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

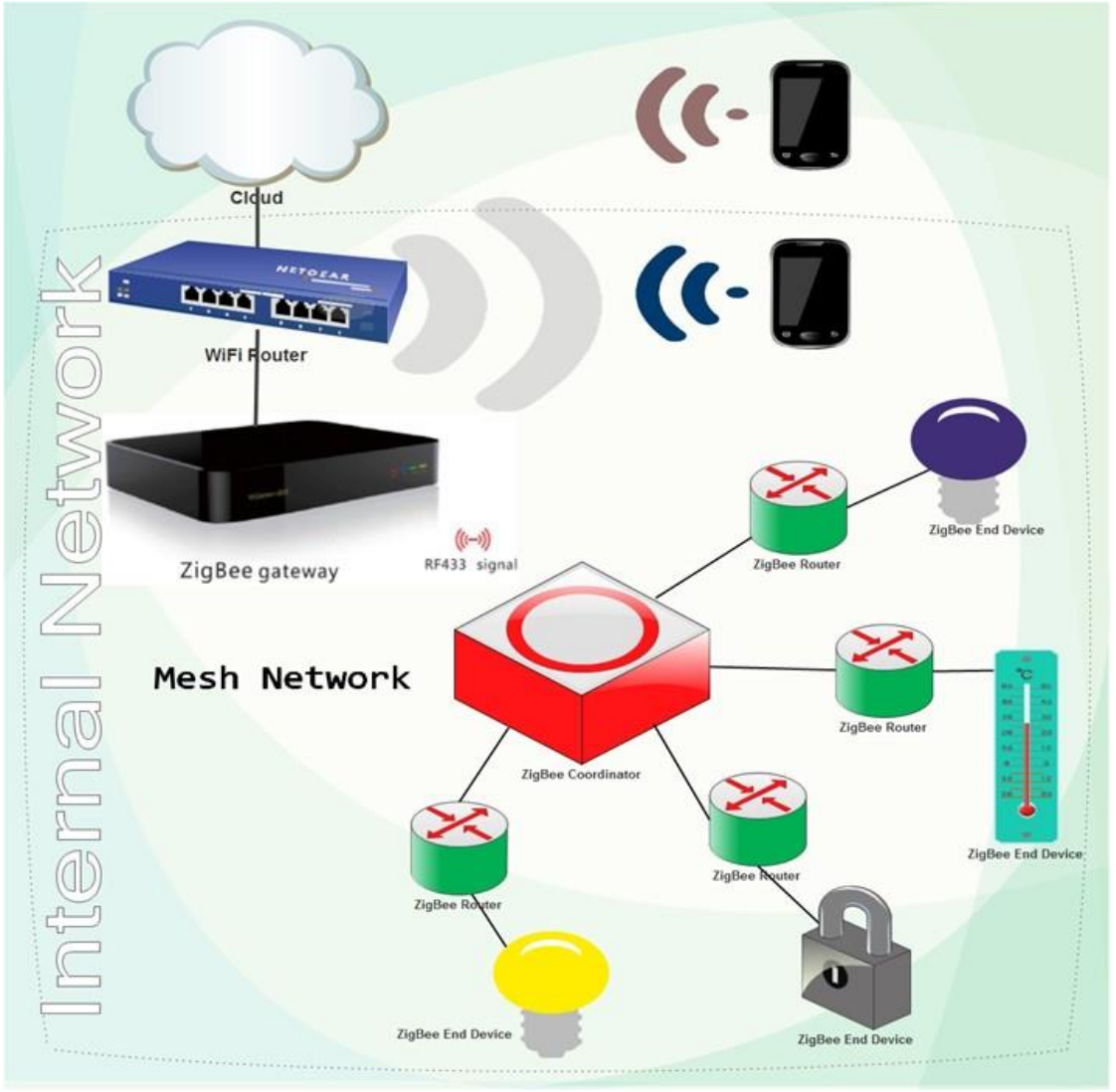
Not “Value” and not “Engineering”

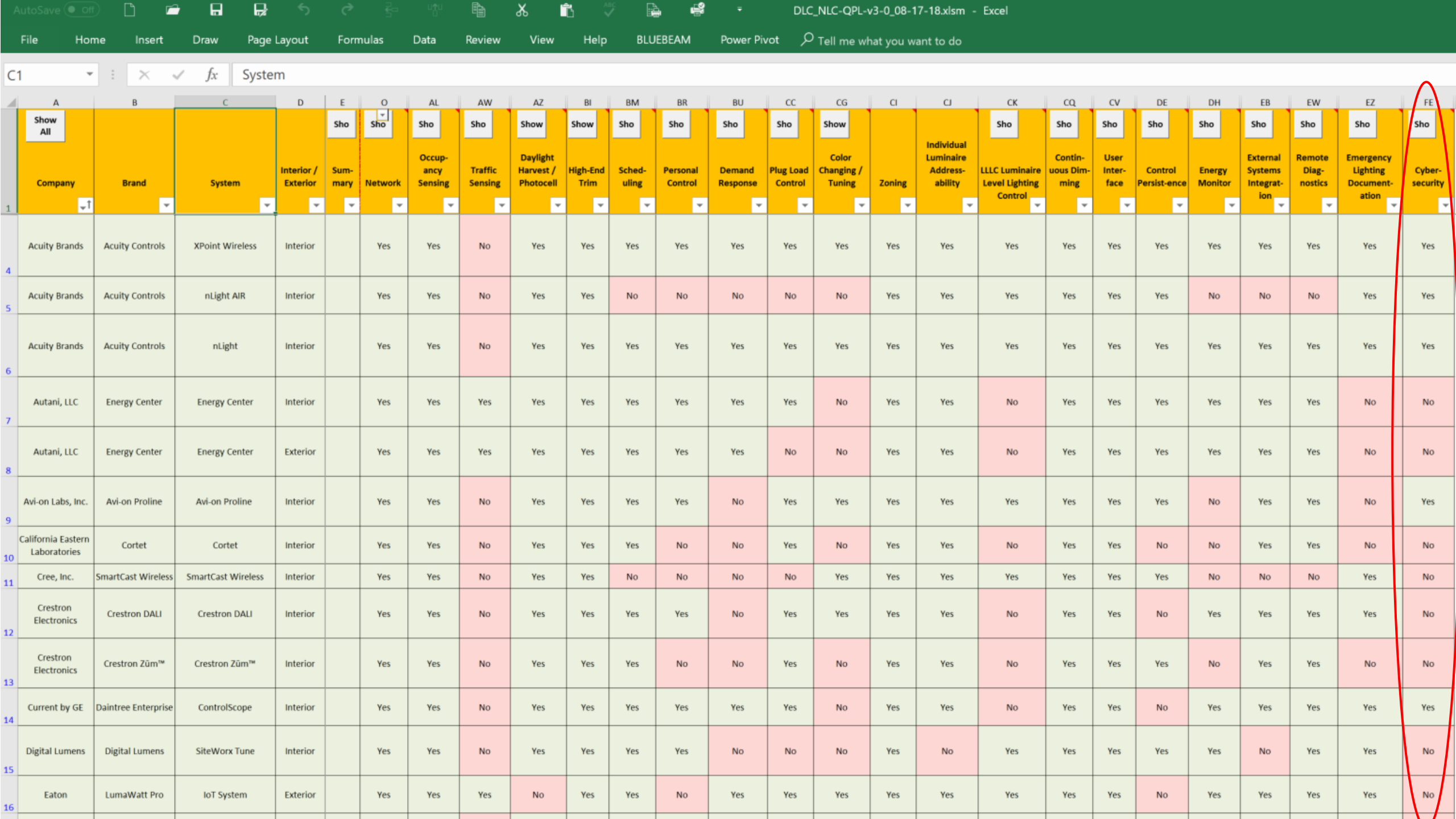
- Removes hardware / features last minute to reduce cost
- Other Building contractors up-sell
  - EC typically down-sell
- True value engineering “adds” to up-front cost to reduce life-cycle cost



Cybersecurity Considerations

- Get IT involved ASAP!
- Smart lighting may be a gateway to attack just like other building systems.
- Becoming a greater issue & consideration.
- Recommend having system-specific network
- Design Lights Consortium
  - DLC NLC QPL
  - UL-2900





AutoSave Off DLC_NLC-QPL-v3-0_08-17-18.xlsm - Excel

File Home Insert Draw Page Layout Formulas Data Review View Help BLUEBEAM Power Pivot Tell me what you want to do

C1 System

	A	B	C	D	E	O	AL	AW	AZ	BI	BM	BR	BU	CC	CG	CI	CJ	CK	CQ	CV	DE	DH	EB	EW	EZ	FE
1	Show All Company	Brand	System	Interior / Exterior	Sho Sum-mary	Sho Network	Sho Occup-ancy Sensing	Sho Traffic Sensing	Show Daylight Harvest / Photocell	Show High-End Trim	Sho Sched-uling	Sho Personal Control	Sho Demand Response	Sho Plug Load Control	Show Color Changing / Tuning	Zoning	Individual Luminaire Address-ability	Sho LLLC Luminaire Level Lighting Control	Sho Contin-uous Dim-ming	Sho User Inter-face	Sho Control Persist-ence	Sho Energy Monitor	Sho External Systems Integrat-ion	Sho Remote Diag-nostics	Sho Emergency Lighting Document-ation	Sho Cyber-security
4	Acuity Brands	Acuity Controls	XPoint Wireless	Interior		Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Acuity Brands	Acuity Controls	nLight AIR	Interior		Yes	Yes	No	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
6	Acuity Brands	Acuity Controls	nLight	Interior		Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Autani, LLC	Energy Center	Energy Center	Interior		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
8	Autani, LLC	Energy Center	Energy Center	Exterior		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
9	Avi-on Labs, Inc.	Avi-on Proline	Avi-on Proline	Interior		Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
10	California Eastern Laboratories	Cortet	Cortet	Interior		Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	No
11	Cree, Inc.	SmartCast Wireless	SmartCast Wireless	Interior		Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No
12	Crestron Electronics	Crestron DALI	Crestron DALI	Interior		Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No
13	Crestron Electronics	Crestron Züm™	Crestron Züm™	Interior		Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	No
14	Current by GE	Daintree Enterprise	ControlScope	Interior		Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
15	Digital Lumens	Digital Lumens	SiteWorx Tune	Interior		Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
16	Eaton	LumaWatt Pro	IoT System	Exterior		Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No

Understand Code Requirements

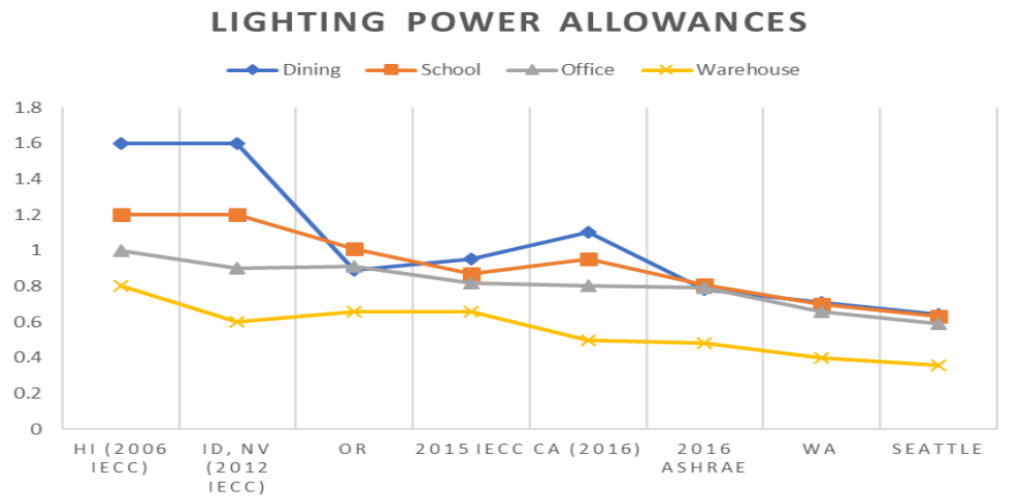
- When does Code Apply?
- LDL 2018 Code Update!
- LPD pushes LED Savings
- Control Implementation Requirements
  - Motion Control
  - Daylight
  - Lighting Reduction (Dimming)
  - Local Control
  - Time Clock Control
- kWh Savings 10% below Code Impact Incentive

TABLE C405.4.2(1)
INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD

Building Area Type	LPD (w/ft²) Before Jan 1 2018	LPD (w/ft²) After Jan 1 2018
Automotive facility	0.64	0.58
Convention center	0.81	0.73
Court house	0.81	0.73
Dining: Bar lounge/ leisure	0.79	0.71
Dining: Cafeteria/fast food	0.72	0.65
Dining: Family	0.71	0.64
Dormitory	0.46	0.41
Exercise center	0.67	0.60
Fire station	0.54	0.49
Gymnasium	0.75	0.68
Health care clinic	0.70	0.70
Hospital	0.84	0.84
Hotel	0.70	0.63
Library	0.94	0.85

TABLE C405.4.2(2)
INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE-BY-SPACE TYPES[a]	LPD (w/ft²)[d] Before Jan 1 2018	LPD (w/ft²)[d] After Jan 1 2018
Computer room	1.37	1.23
Dining area		
In a penitentiary	0.77	0.69
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.52	1.52
In a bar/lounge or leisure dining	0.86	0.77
In a family dining area	0.71	0.64
Otherwise	0.52	0.47
Electrical/mechanical	0.76	0.68
Emergency vehicle garage	0.45	0.41
Food preparation	0.79	0.71
Guest room	0.38	
Laboratory		
In or as a classrooms	1.02	0.92
Otherwise	1.45	1.31



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Implementers – Leverage Partner's Procedural Efficiency

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

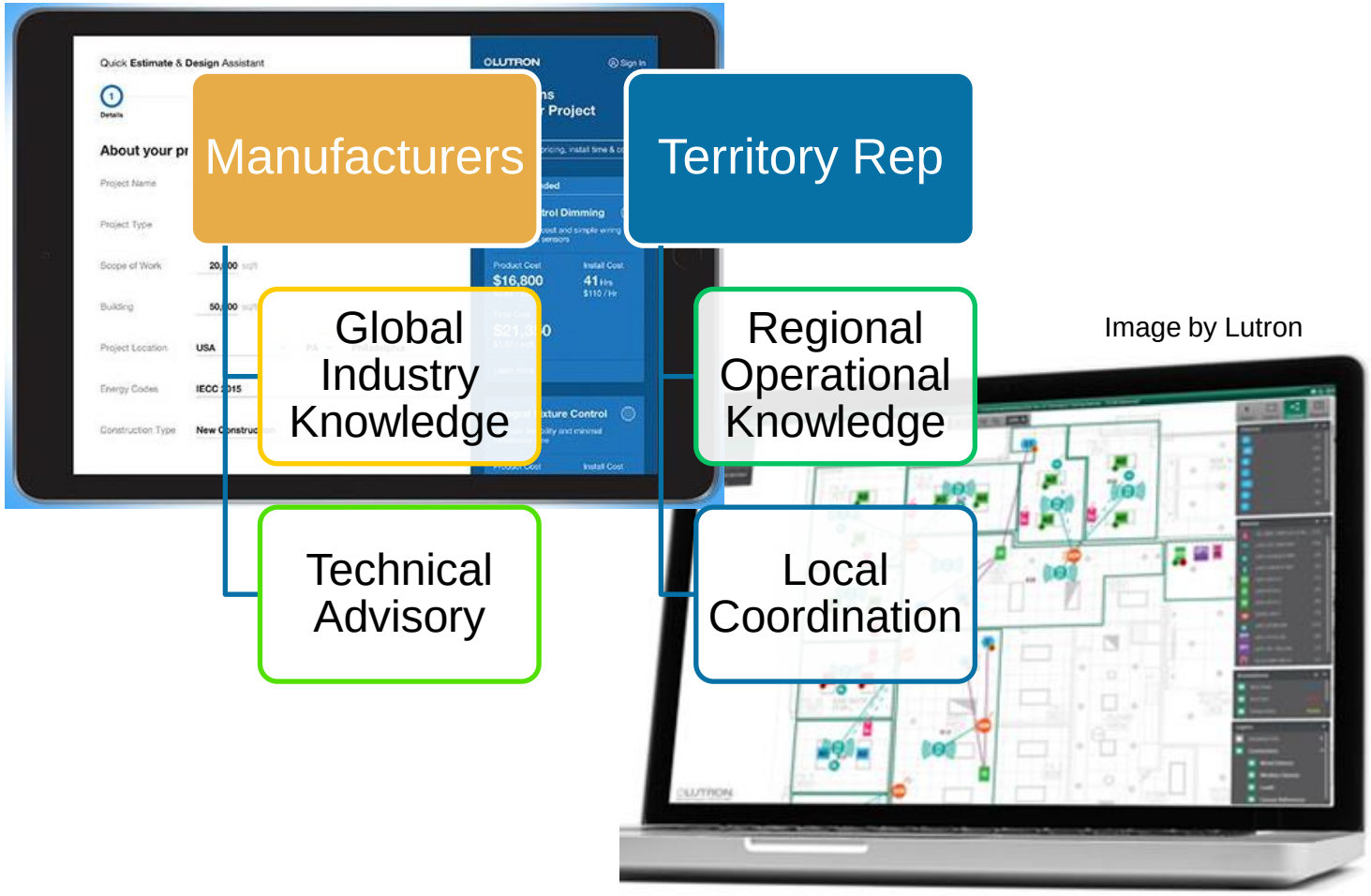


Image by Lutron

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 programming

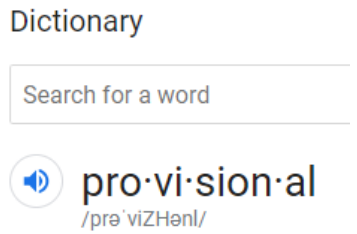
Program Design *Considerations:* **Savings & Incentives**

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!

lighting design lab

City Light NLC $50/Fixture 2020 Requirements

- DLC NLC QPL System
- Programmed HET, Occupancy, Daylight Harvesting
- Min (2) Zones per 300sqft
- Pre-Install
  - SOO
  - Floor Plan
- Post-Install
  - As Builts
  - Site Visit

- TLEDs
- Fixtures under 20W
  - HET under 20W = prorated $50 incentive

Seattle City Light

CUSTOMER ENERGY SOLUTIONS
PROGRAM REQUIREMENTS

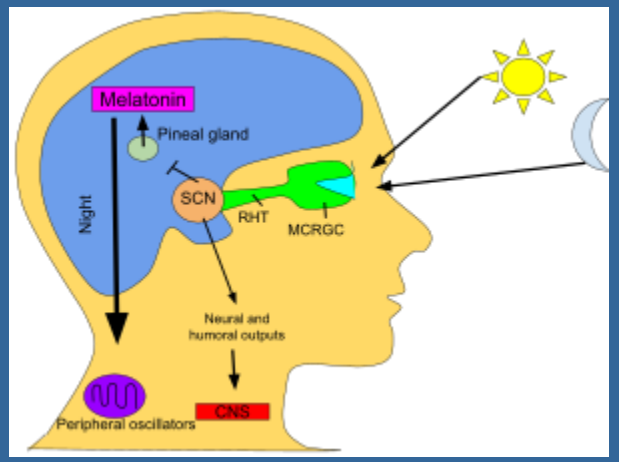
Commercial and Industrial Retrofit Program

lighting design lab

Select all benefits of a Lighting Audit

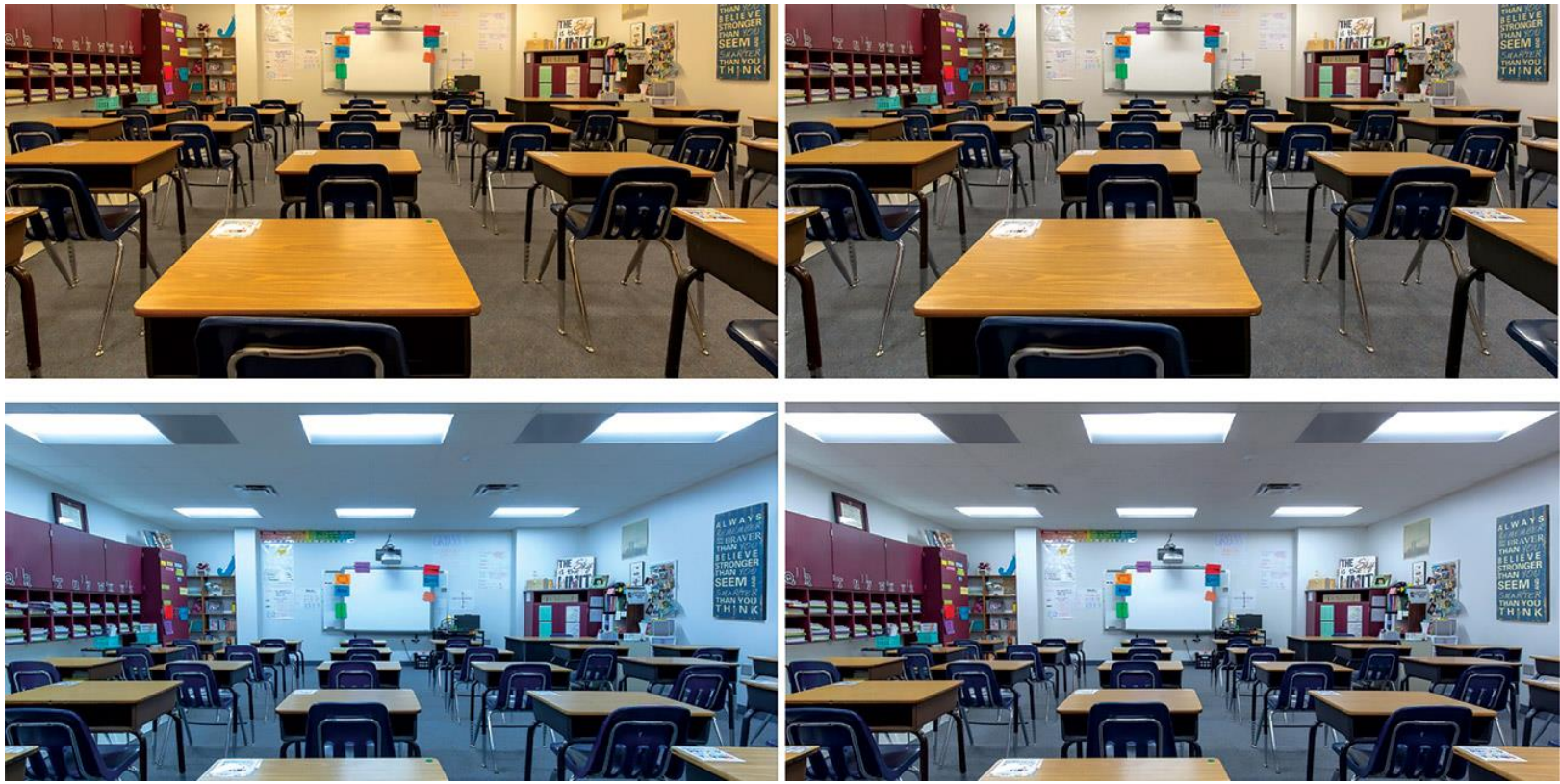
Pause for Questions

Light & Health 101



Tunable White, Circadian Lighting

- Specific color tuning adjusting the correlated color temperature / SPD along the black body radiator curve.
- Meant to affect mood or alertness.
- Circadian lighting
- Light & health ongoing research



Key Light Stimulus Variables for Circadian Entrainment

- Circadian Entrainment
  - Intensity
  - Distribution
  - Spectral Power Distribution
  - Duration – Dose
  - Timing
  - Photobiological History

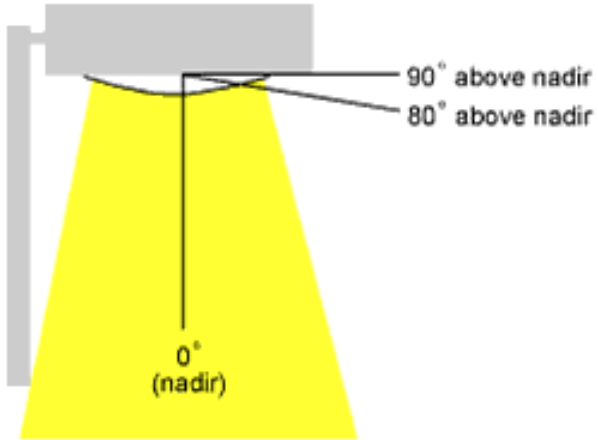
Intensity

- How much light is incident on the eye
- Lux
- Typically measure at seated eye height for most environments

St John's Hospital

Distribution

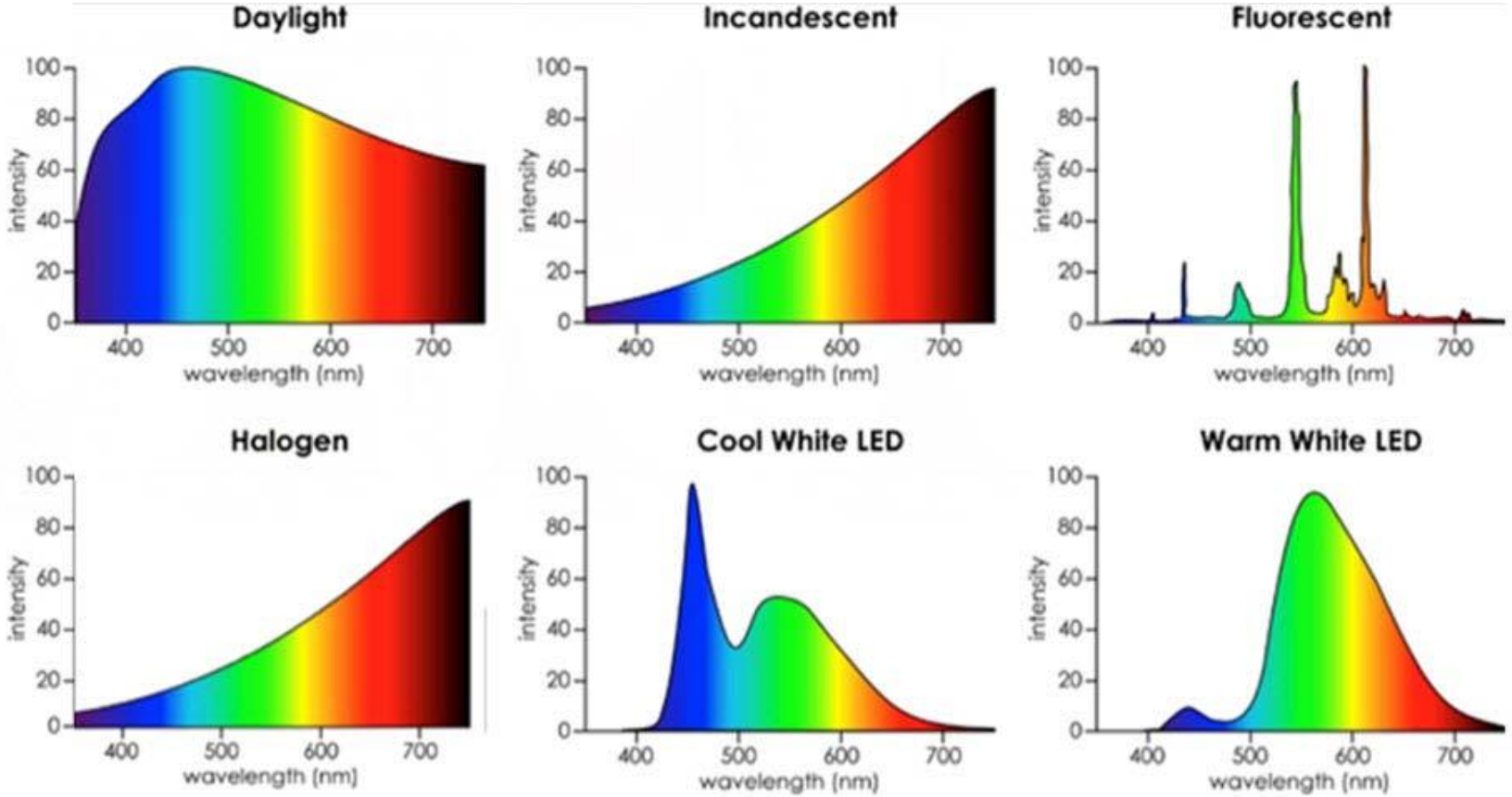
- Direction of light matters
- 90 degrees from nadir and higher
- Think about blues sky light



Cook Hospital

Spectral Power Distribution

- What wavelengths are present in the light source
- Heavy reliance on blue wavelengths
- Research is showing this may not be as important as thought
- Non-visual photoreceptors (ipRGC) benefit from SPD



Duration - Dose

- How long are you subjected to the light stimulus?
- At what intensity was the light stimulus?
  - Both matter

Courtesy of Signify

Timing

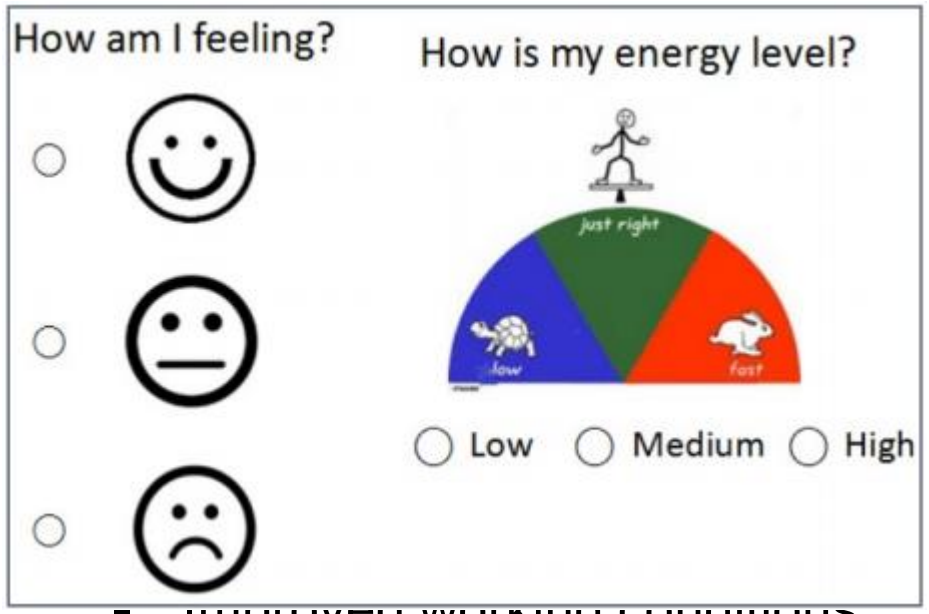
- What time are you subjected to the stimulus?
- Resetting the circadian clock at 5:30 pm may not be the best choice for day active workers.
- What about for students?
  - ~8am – ~3pm

Photobiological History

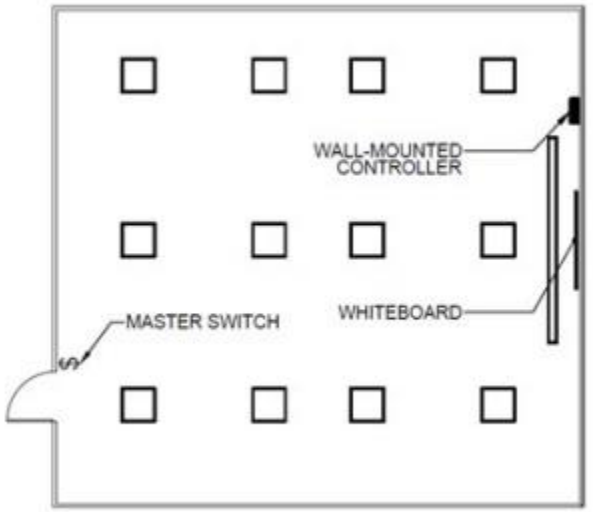
- The patterns of light exposure during the day and over time matter
- Intensity ranges may be critical over time
- How does this effect shift workers?

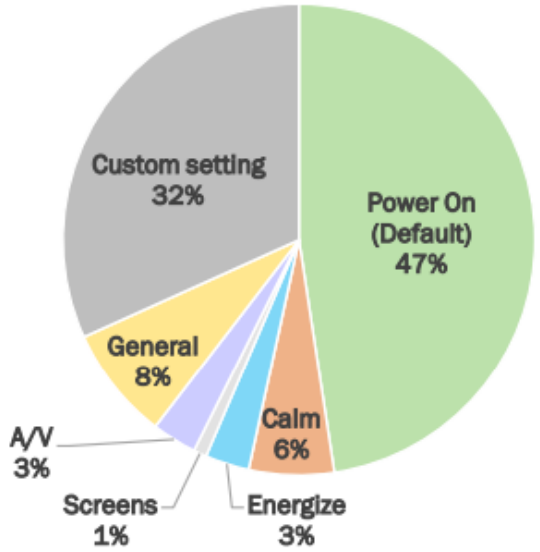
Tunable White in Classrooms – PNNL & DOE 2018-2019 Study

- Study Conclusions



- Improved working conditions and learning environment for teachers and students

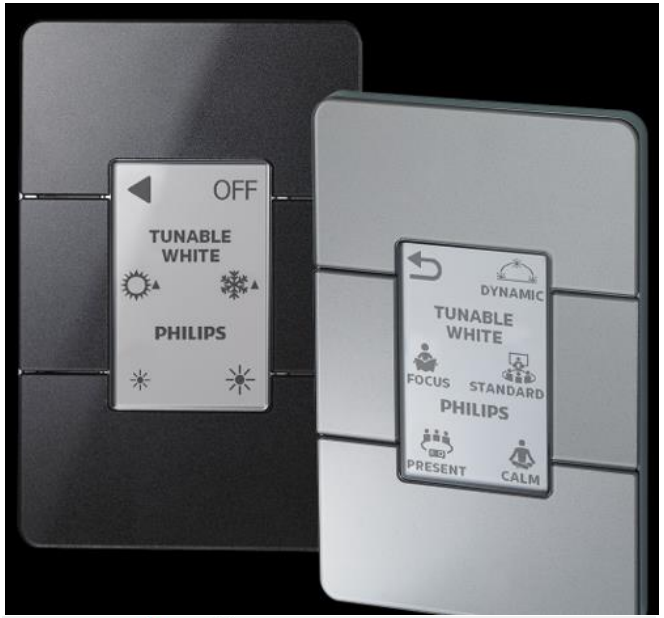


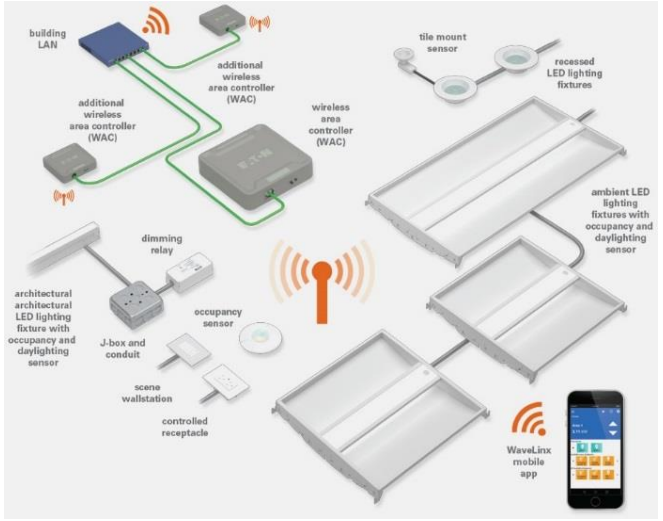


Lighting Controls to the Rescue

- Intensity
- Distribution
- Spectral Power Distribution
- Duration – Dose
- Timing
- Photobiological History

- If only we had a convenient means of manipulating most of these variables….



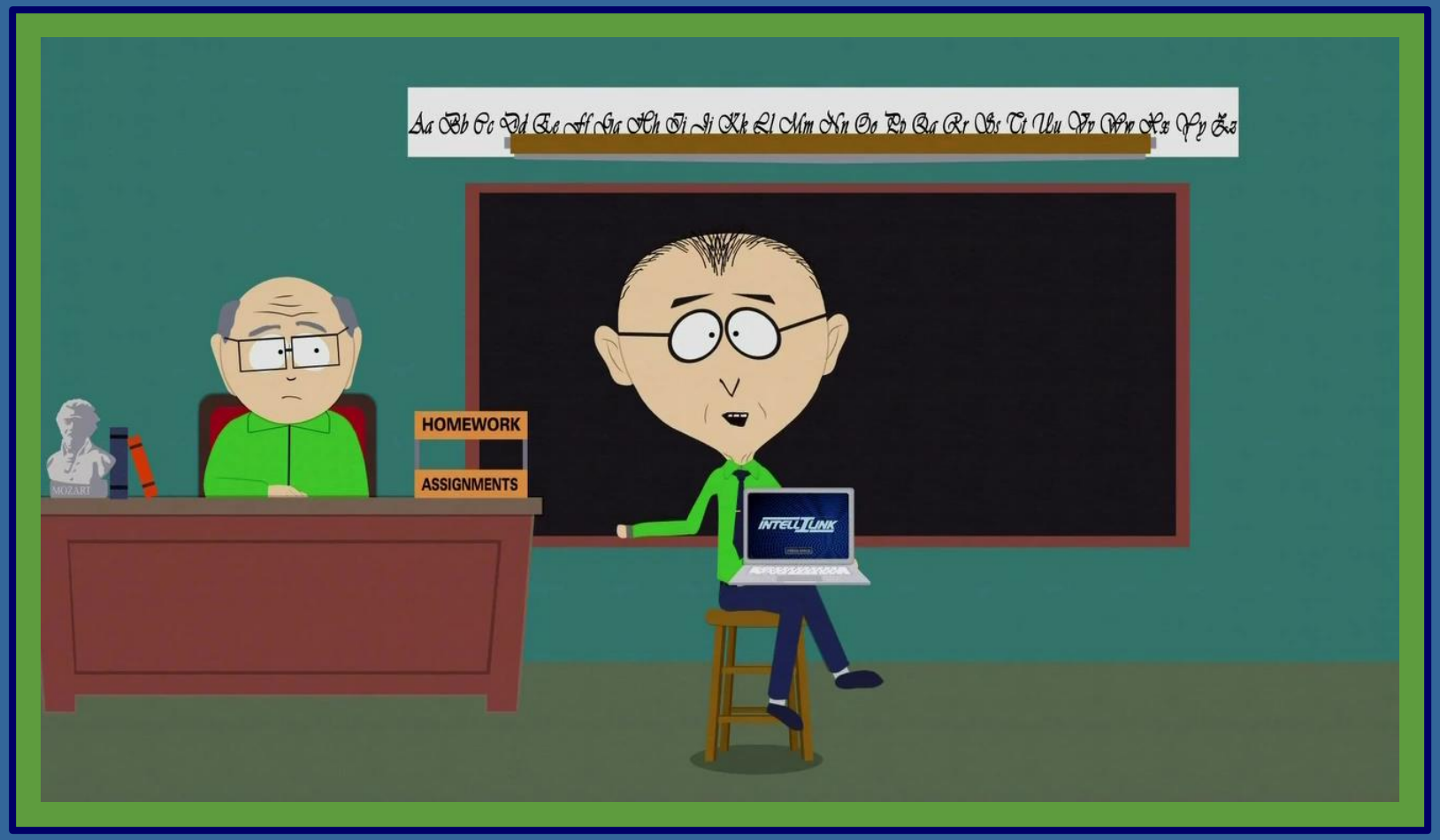


Courtesy: Signify, Eaton

Select variables that affect Circadian Entrainment

Pause for Questions

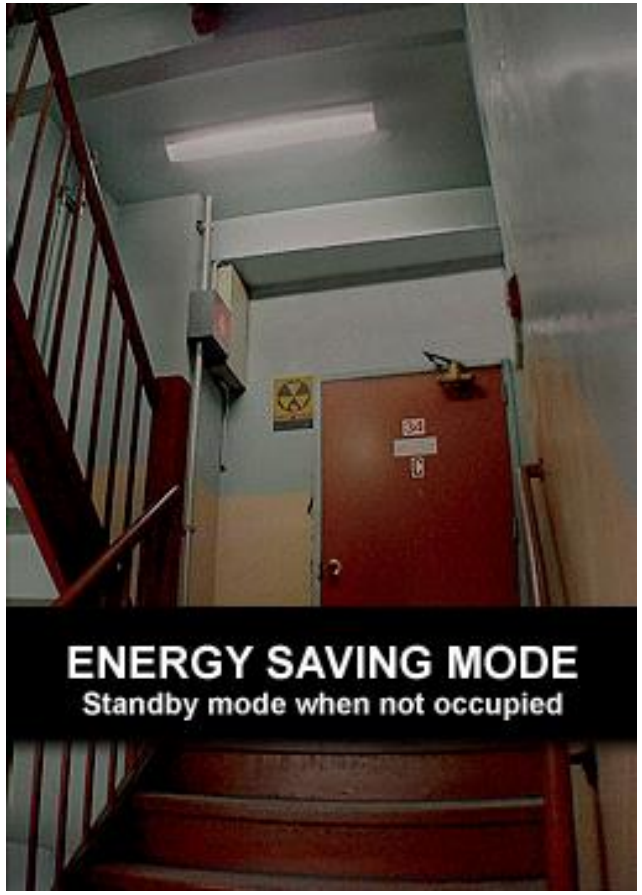
NLC Implementation & Applications

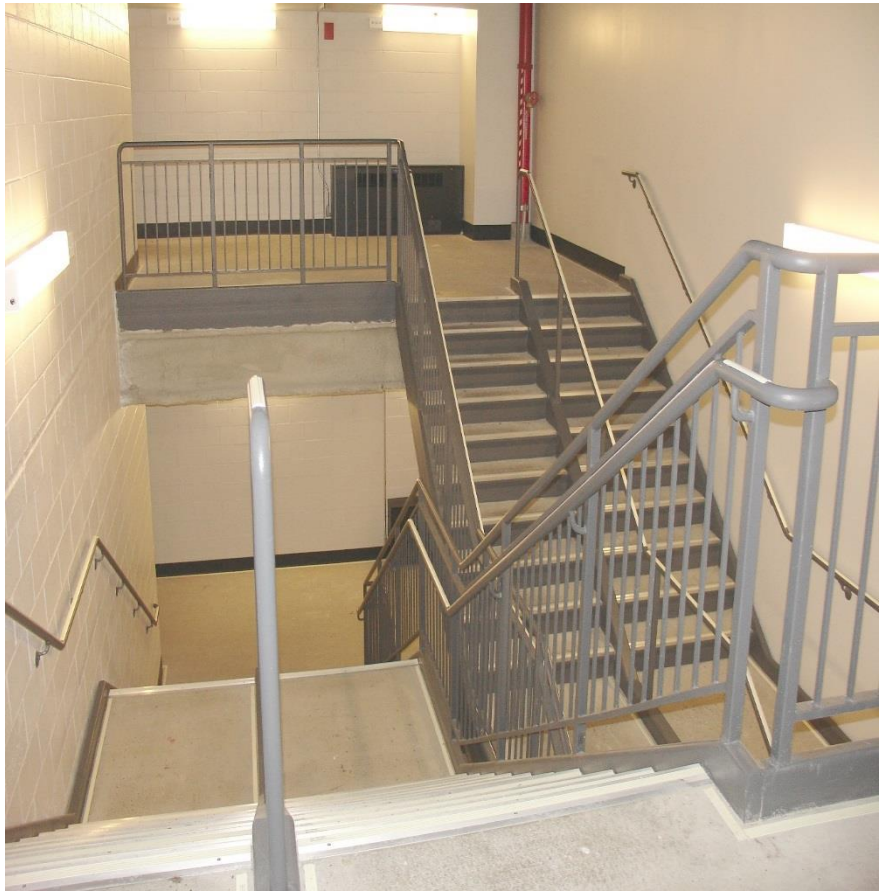


Stairwells and Corridors and Garages

- Each space shall have one or more Load Controller and Sensor
- Automatically reduce lighting power by not less than 50% when vacant for 15 minutes (30 for Garages… or refer to code)
- Restore lighting to full or a higher level (50%+) when occupants enter the stairway.

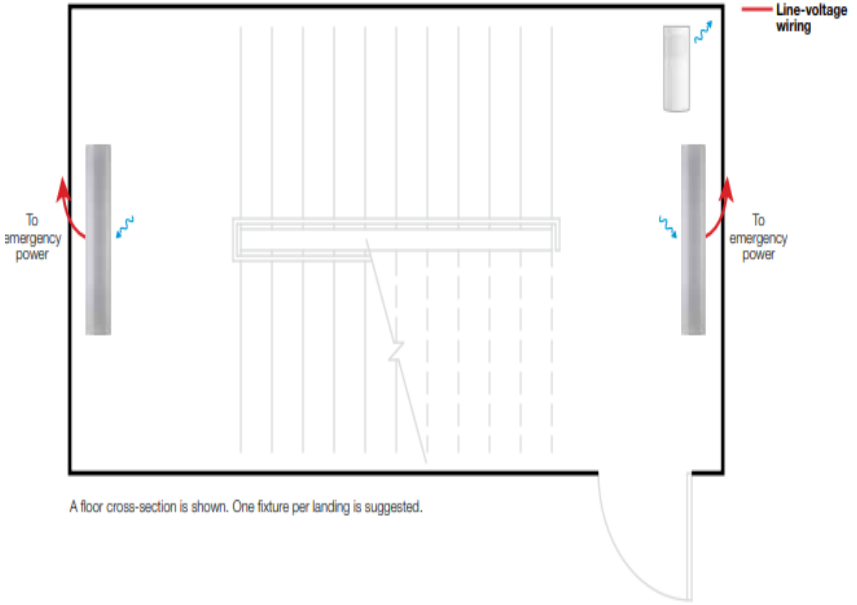
Stairwells and Bi-Level Dimming





NLC + LLLC Approaches

Separate Corner Mount Sensors



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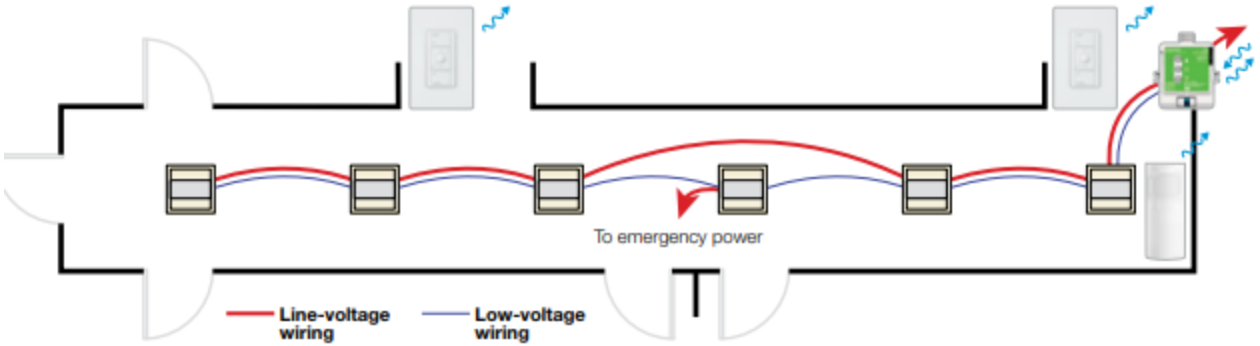
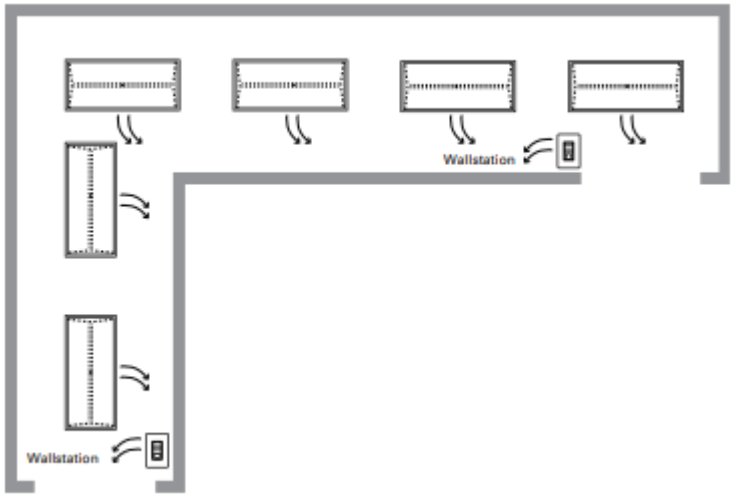
Corridors



- Some hallway sensors can have coverage beam of 1500 ft
- Hi-Low
- Manual control optional

LLLC Benefits in L-Shapes!



Restrooms

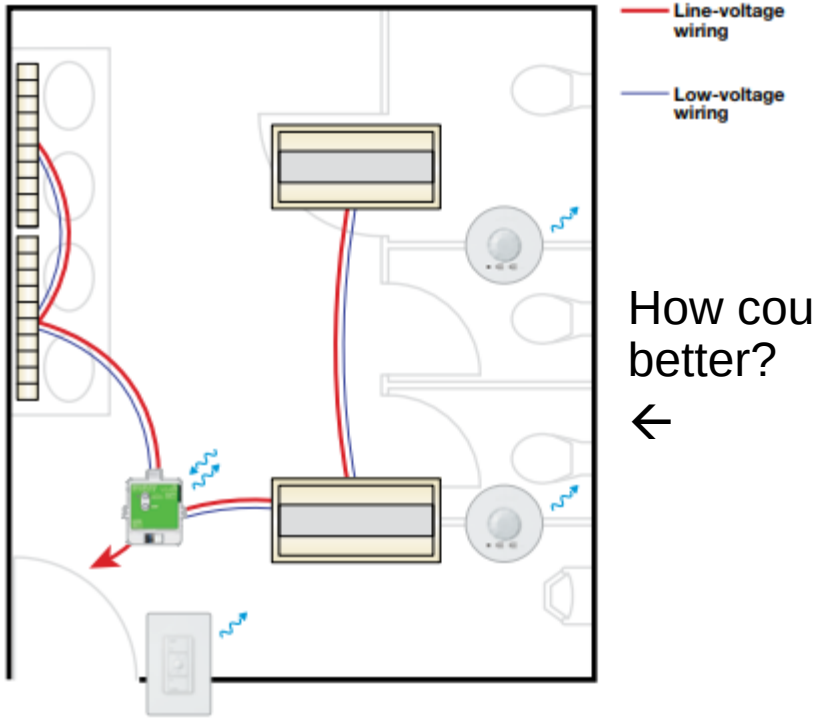
Single Stall

What's the difference here?

←

Can also implement connected sensors, load controllers, and wall station (optional)

Multi-Stall

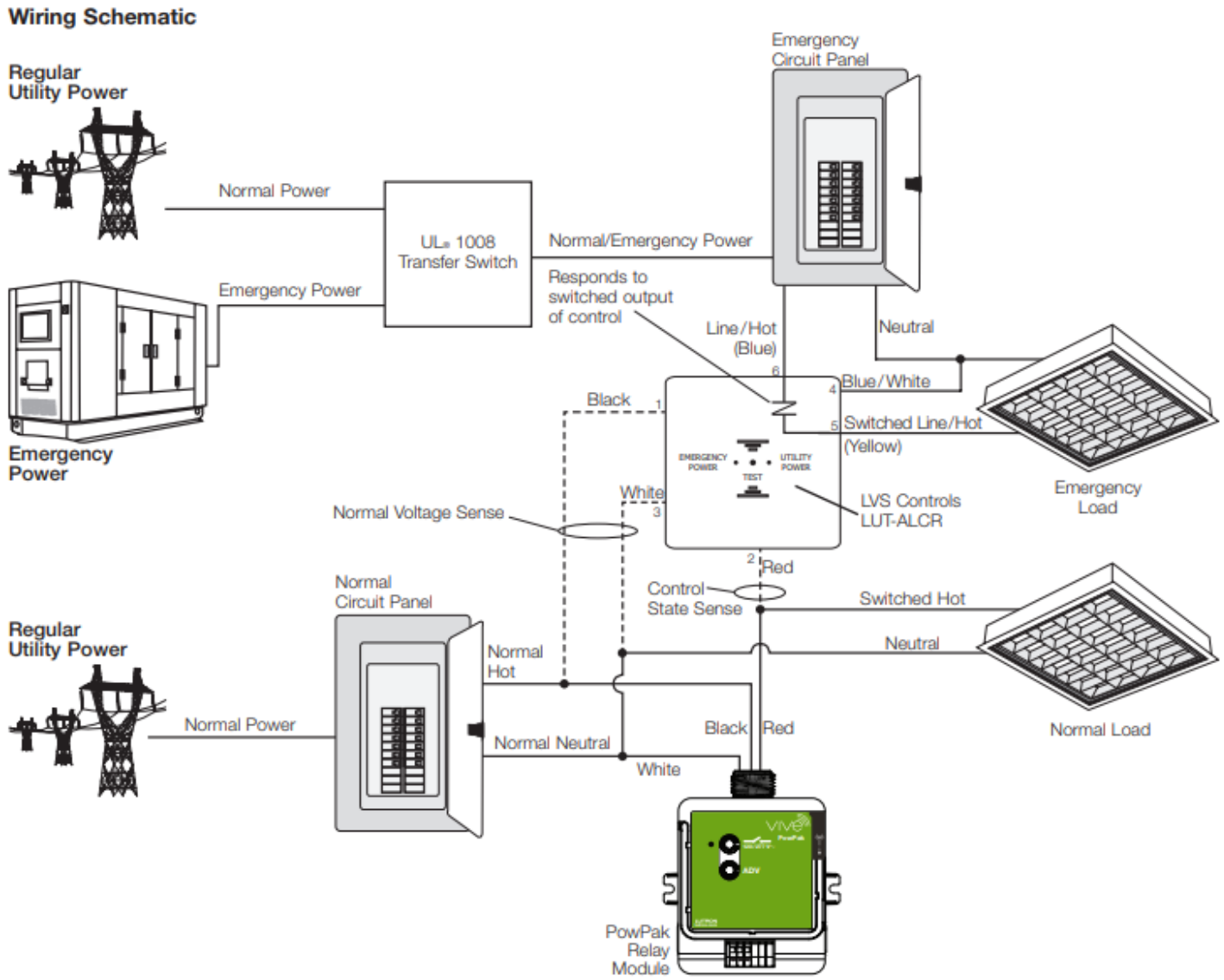


How could this be better?

←

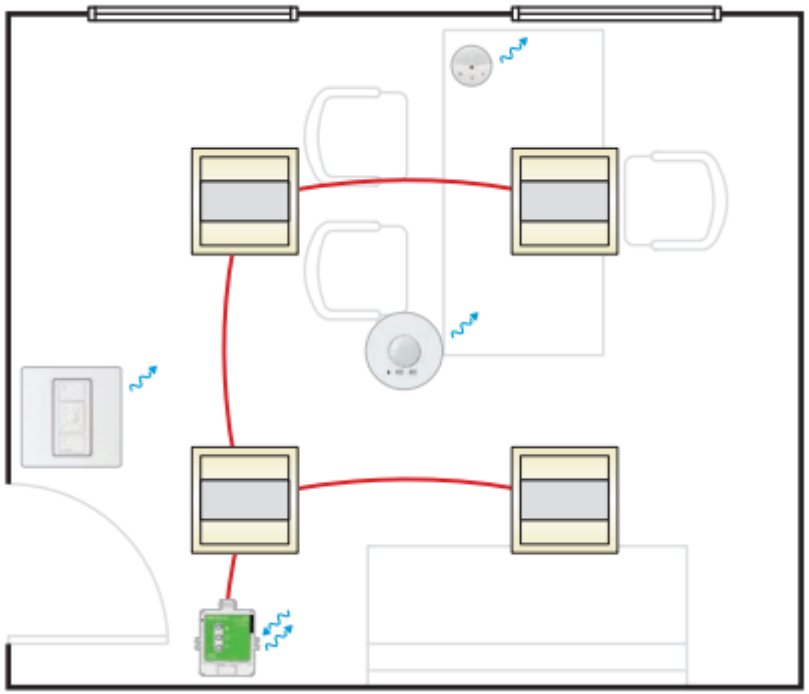
Emergency – 24-hour lighting?

- Emergency lighting was frequently provided by a 24-hour constant hot circuit in the past.
- That is no longer allowed in most cases and codes!
- UL924

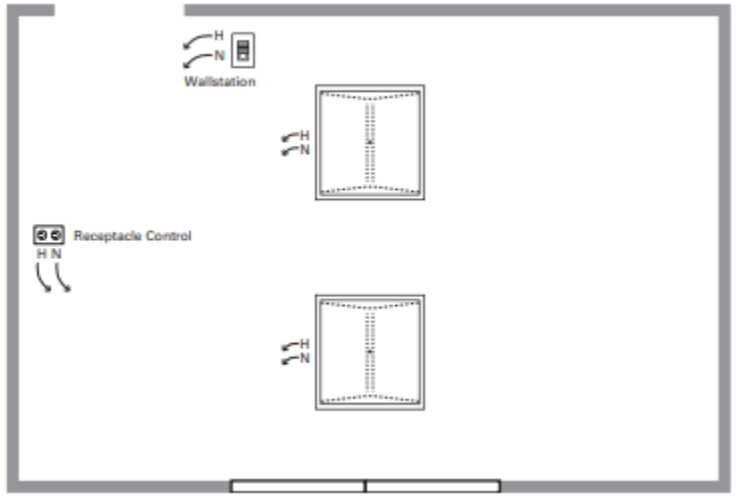


Private Office

NLC Design

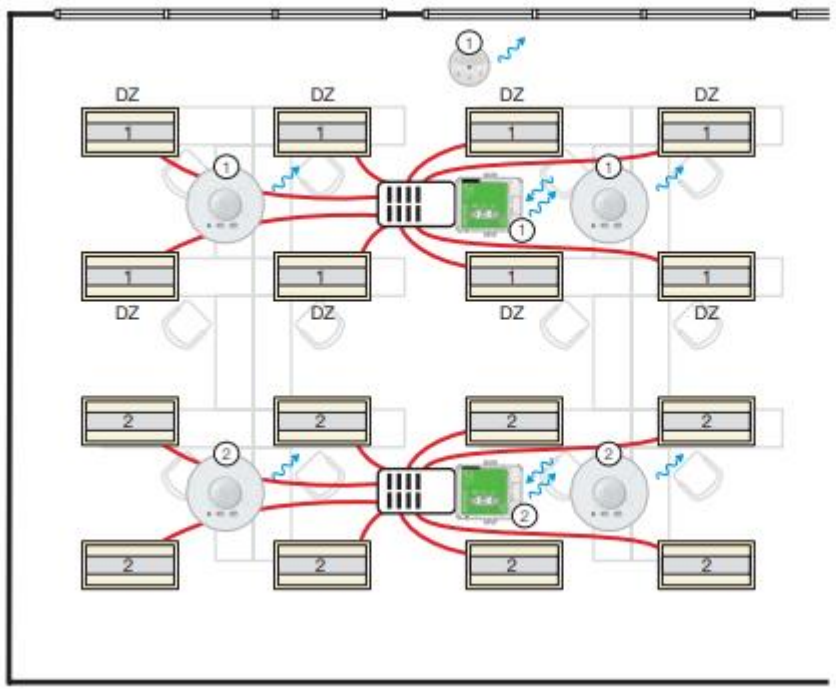


LLLC Design



Receptacle Control!

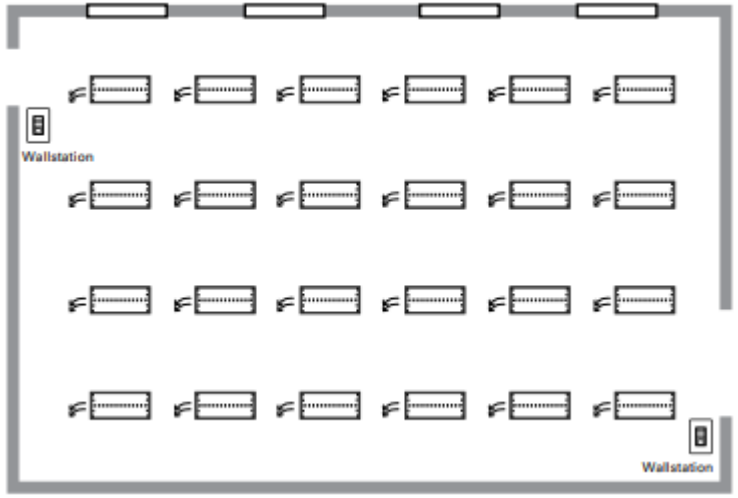
Open Office



Line-voltage wiring

Clear Connect RF Communication

DZ = Daylight Zone



Sequence of operations

Lighting

0-10V lighting loads
Up to 3 dimmable zones
Out of the box 75% high end trim

Occupancy

Automatic on to 50%
Optional vacancy mode
Optional auto on to scene
Optional plug load turns on/off with occupancy
Automatic off of lighting and plug load on vacancy

Daylighting

Continuous dimming to off
Individual luminaire daylight dimming to approximately 500 lux
Daylighting not required for indoor space without windows
Not required in spaces without windows or that are less than 150W

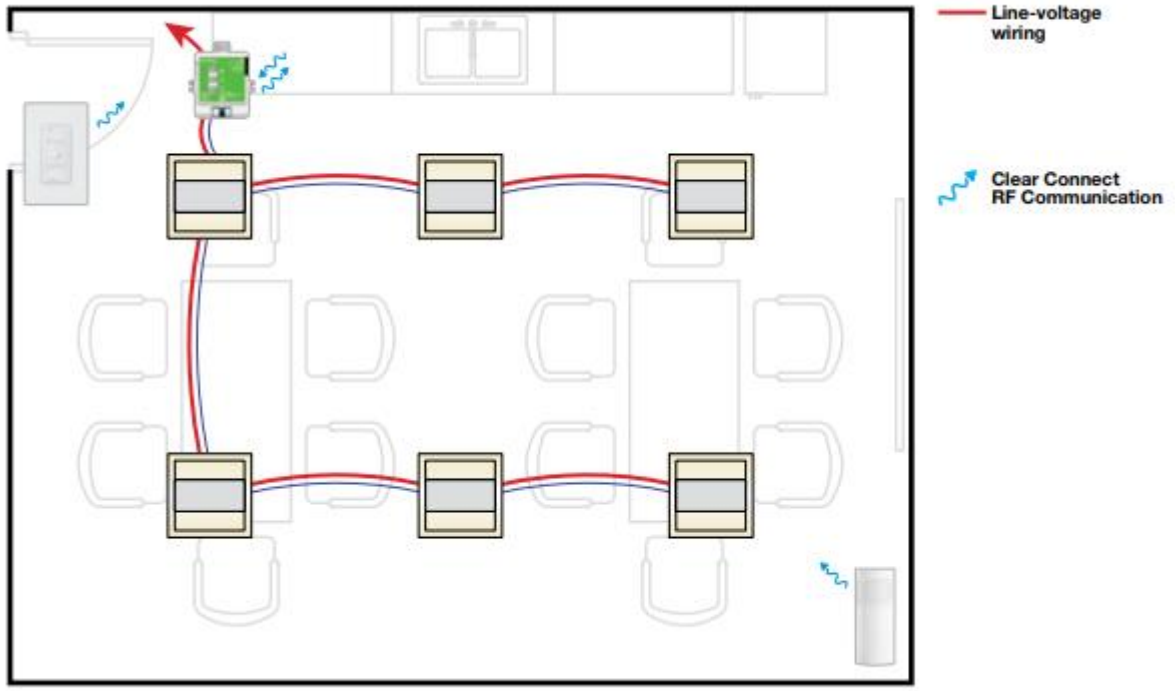
Manual Controls

Top or dominant button half lights (sets lights to 50% or less)
Remaining buttons trigger scenes
Raise
Lower
All off

Additional Features

Power measurement reporting through mobile application
Automatic demand response available from wireless area controller
Scheduling of partial off light levels and times from wireless area controller
UL924 emergency control capabilities available via luminaire battery backup

Break Room



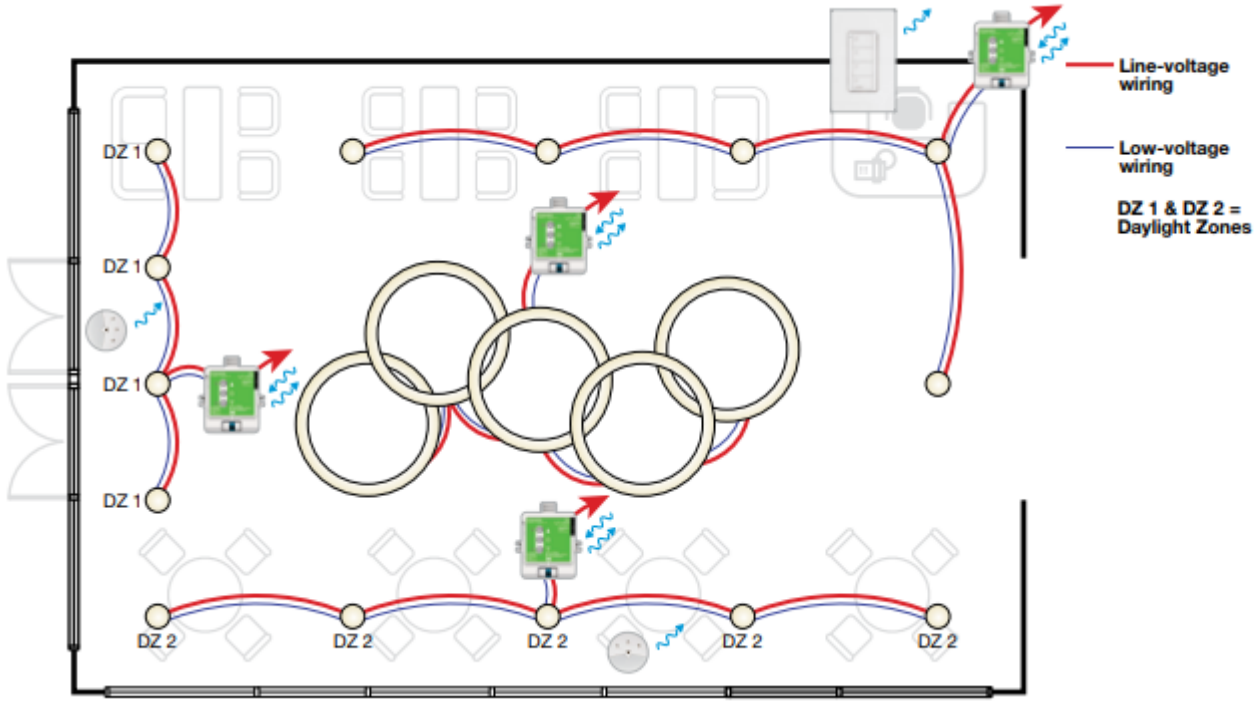
Control Functionality

Occupant Enters:
Lights do not automatically turn on when an occupant enters the space; lights must be turned on manually. Maximum light level is set to 80%.

When Occupied:
Manual: Occupant uses wall dimmer to set desired light levels for all lights.

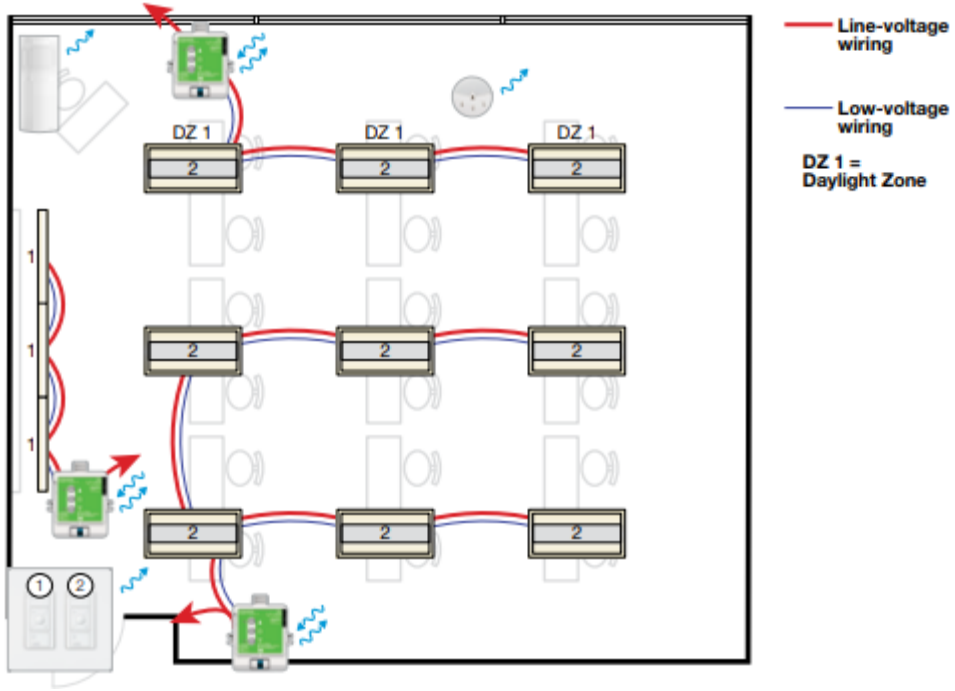
Occupant Exits:
All lights automatically turn off 15 minutes after all occupants exit.

Atrium

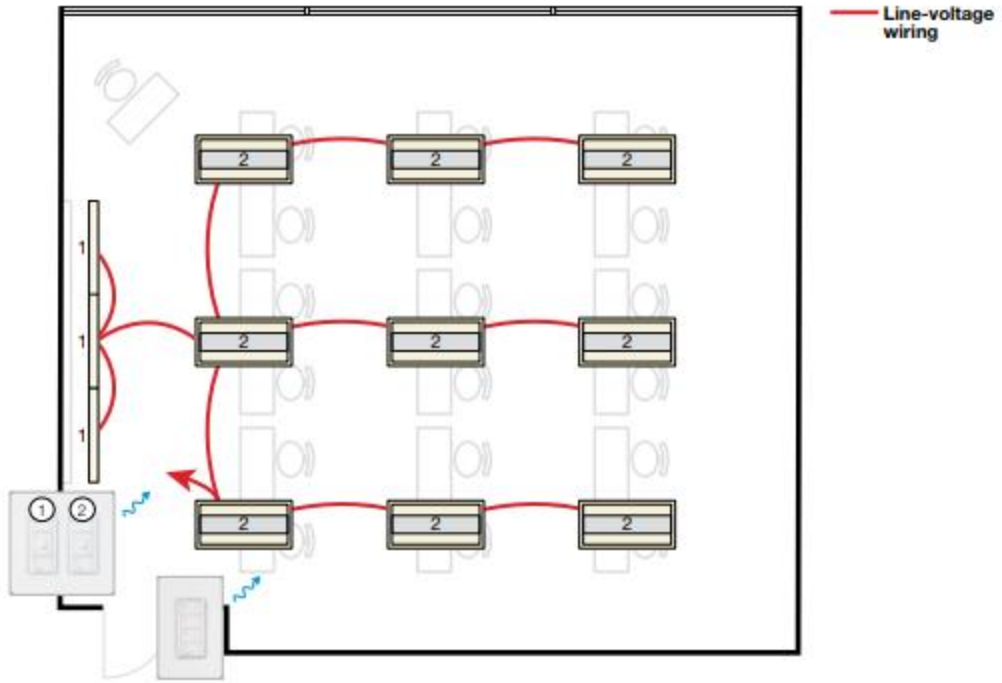

DZ 1
DZ 1
DZ 1
DZ 1
DZ 2
DZ 2
DZ 2
DZ 2
DZ 2
Line-voltage wiring
Low-voltage wiring
DZ 1 & DZ 2 = Daylight Zones

Classroom

NLC Design

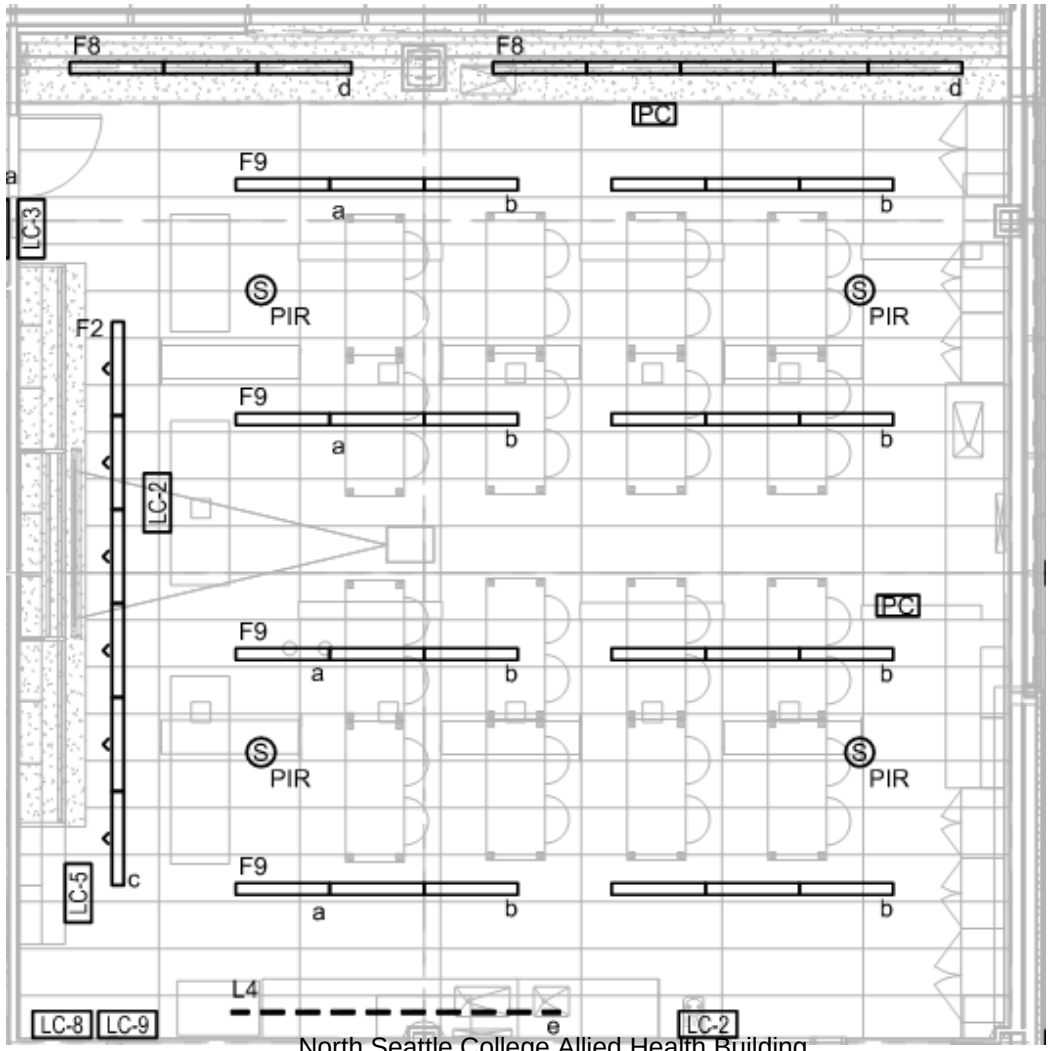


LLLC Design



- Can also use ceiling sensors
- Quantity depends on sqft

Classroom with many zones



North Seattle College Allied Health Building

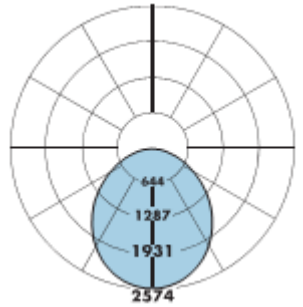
Similar to a Lab

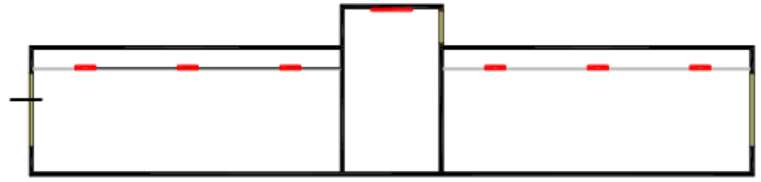
Difference:

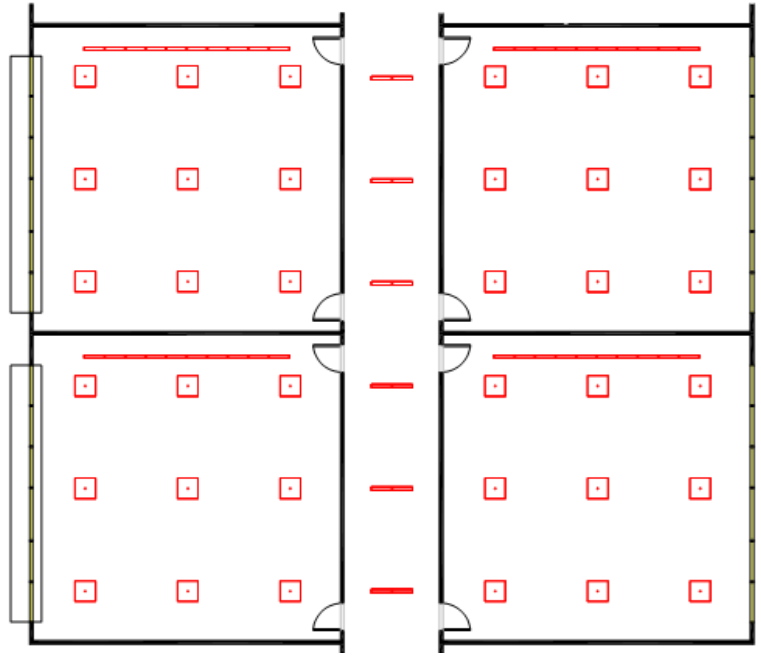
- Use wall sensors between vertical obstructions in a Lab!

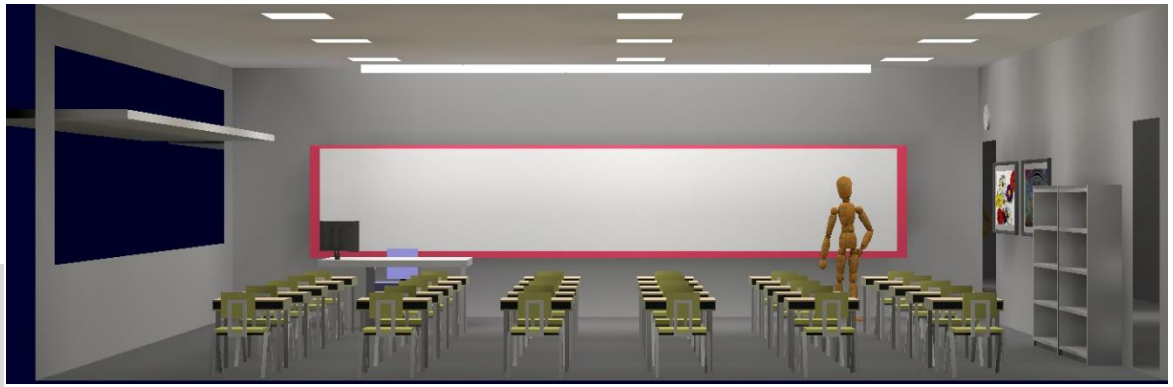
10’ Ceiling Recessed Troffers

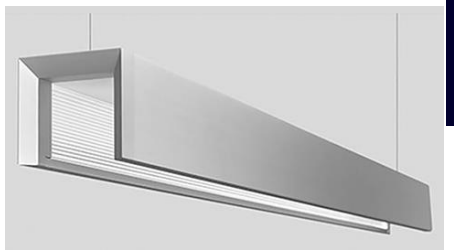
- AVG: 46
- AVG: Min : 1.7:1
- LPD: 0.53 W/sf

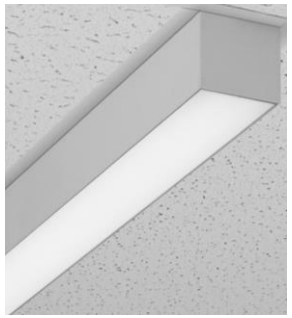












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Rep/Manufacturer Should be Involved – They Know Their Stuff!

IECC 2015 Commercial Energy Code Application Guide

Suggested Code Compliant Solutions

Diagram key:

● = New construction ⚙ = Lighting retrofit[1] ⚙ = New construction and retrofit[1]

			Atrium	Classroom, Lecture Hall, Training Room	Conference, Break Room	Corridor[2]	Lobby	Open Office (>300 sq. ft.)
Manual Control	Switch			⚙	⚙			
	Dimmer or scene control		⚙			⚙	⚙	⚙
Automatic ON/OFF Control	Timeclock		⚙					
	Occupancy sensor			⚙	⚙	⚙	⚙	⚙
	Settings	Full ON				⚙	⚙	
		Partial ON	⚙					⚙
		Manual ON		⚙	⚙			
		Full OFF	⚙	⚙	⚙		⚙	⚙
		Partial OFF				⚙[5]		
Other	Daylight responsive control		⚙	⚙[6]	⚙	⚙	⚙	⚙[6]
	Receptacle control							
	Demand response							

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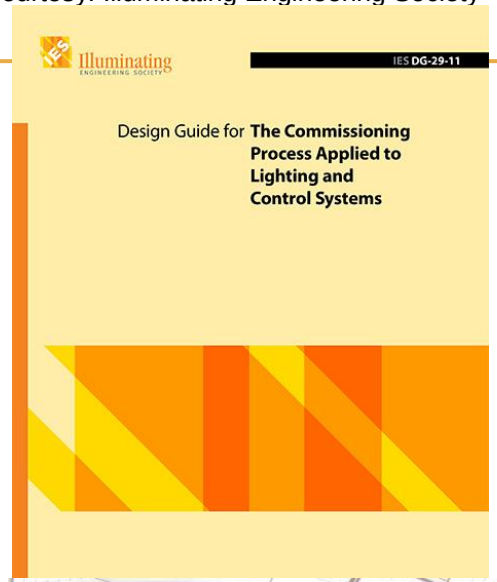
Commissioning vs. Startup

- Third Party Commissioning may be required
  - Commissioning Plan
    - Includes Optimization
  - Certified Commissioning Professional
    - Ie Title 24 / LEED / WELL
  - Functional Testing/Adjusting
  - Final Report (Docs required)
- Startup:
  - Initial programming of a system and its components

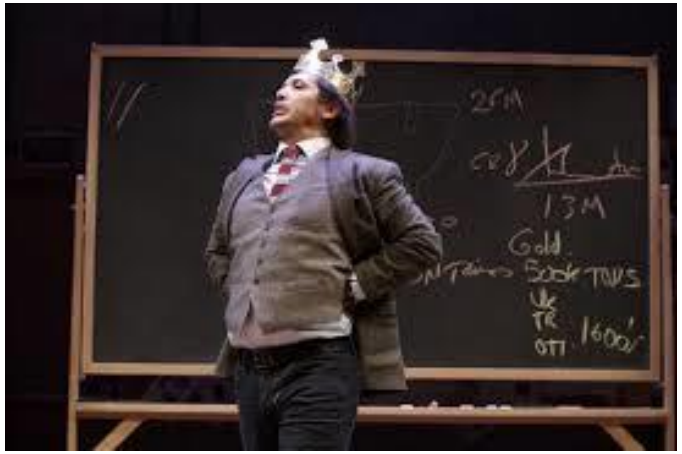
Courtesy: Illuminating Engineering Society

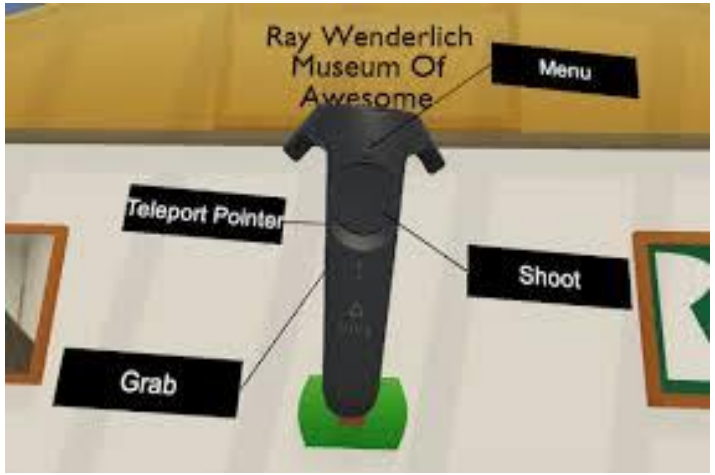


Important & Overlooked Commissioning

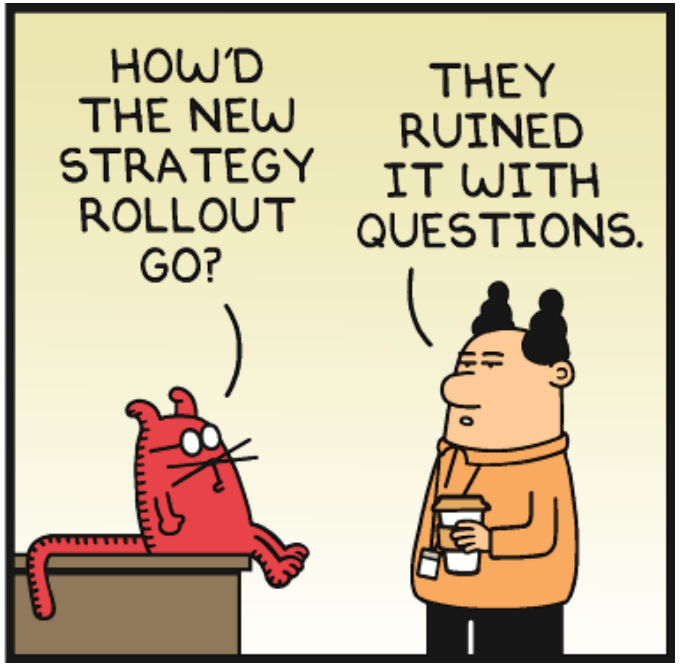
Commission the occupants….

- Let them know what to expect from the system and how it operates….and why….
- Teachers can be kings in their domain
- Empower tenants to interact with the space for their needs



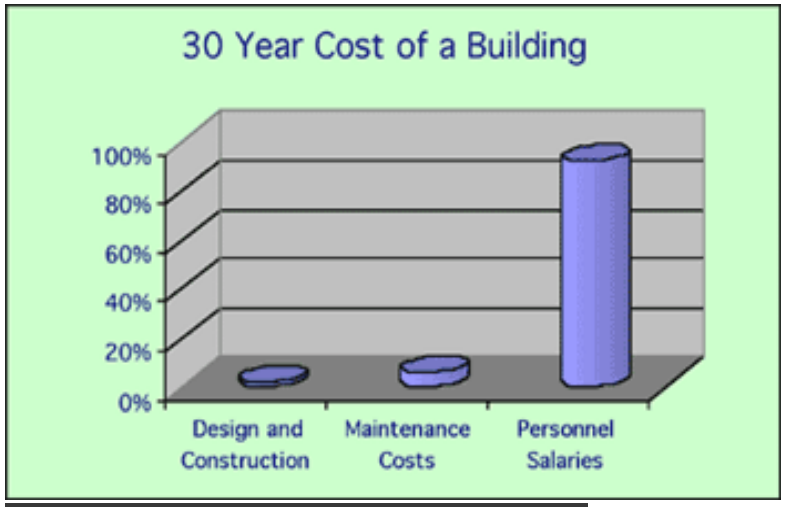


Pause for Questions



Finance, Budgeting, Overcoming Some Barriers

Connected Lighting Prospectus for Buildings



National Institute of BUILDING SCIENCES™

The 1-9-90 Rule

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

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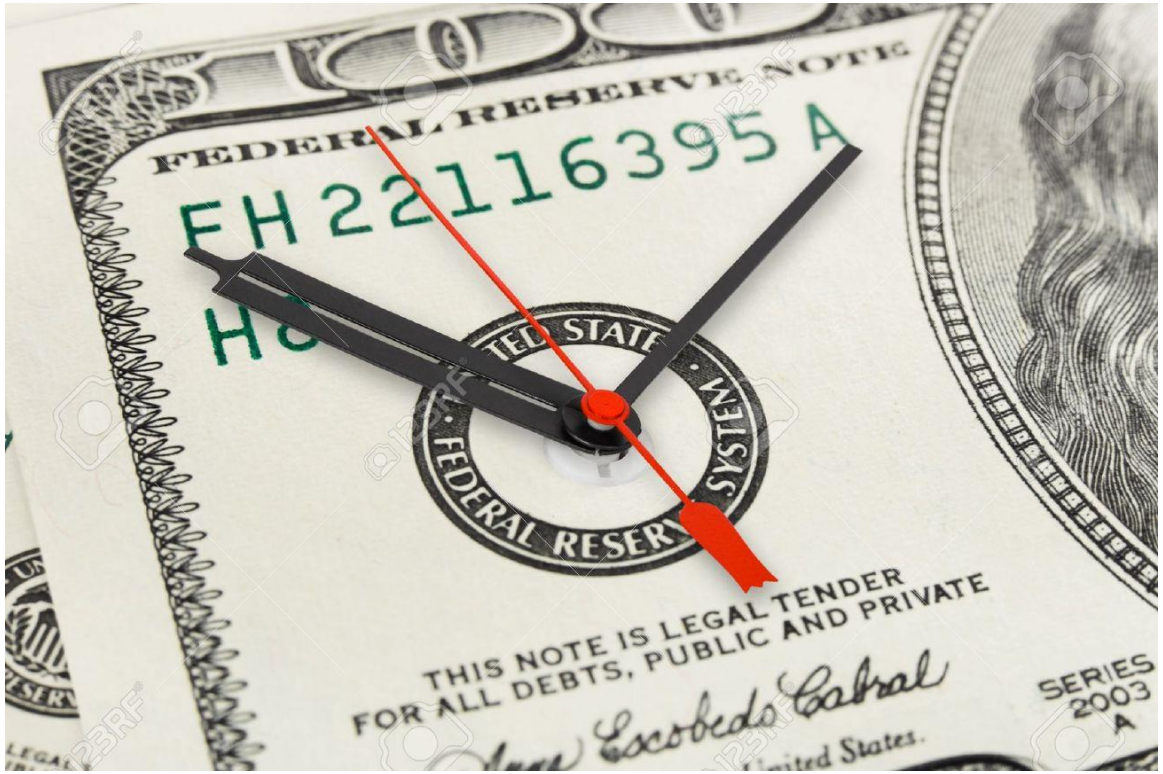
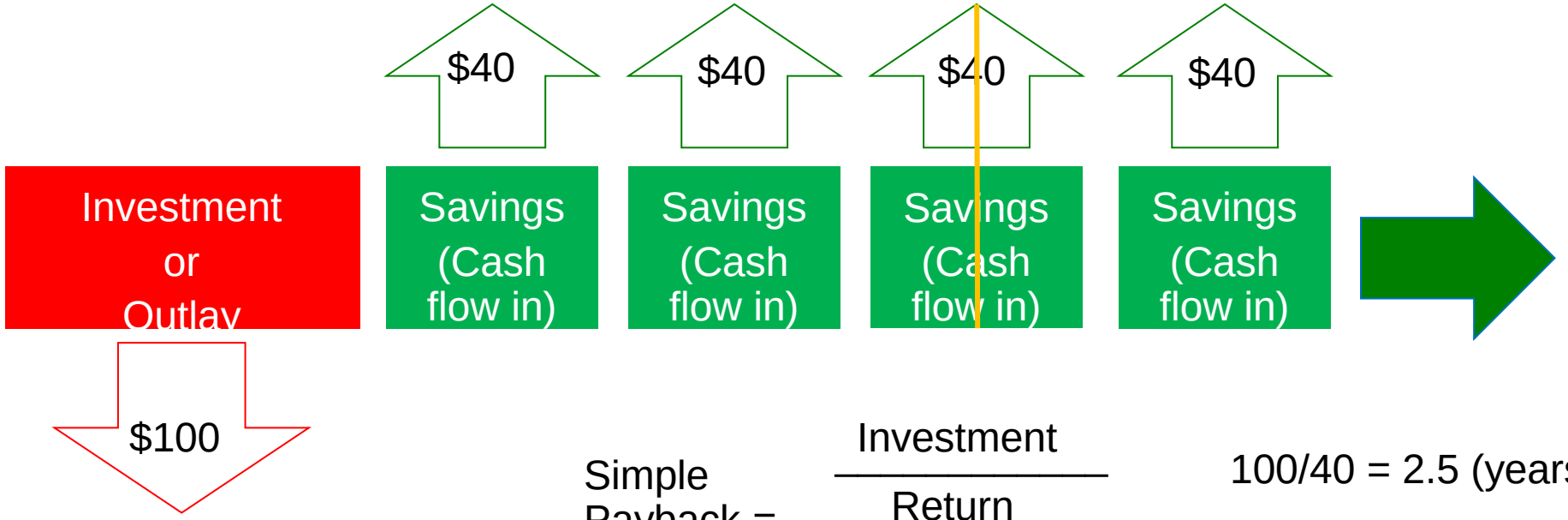
Discuss The Cost of Waiting

- 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



Simple Payback vs. Life Cycle Cost



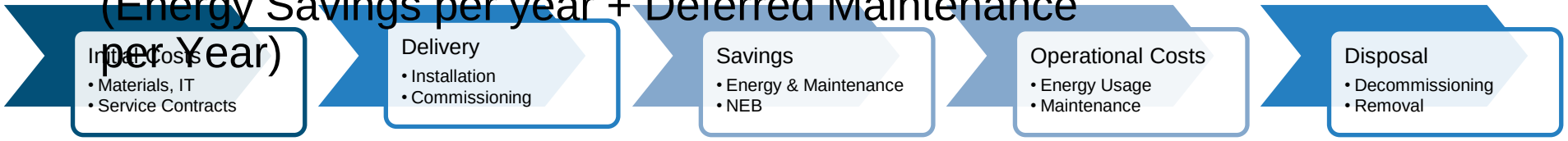
Simple Payback = $\frac{\text{Investment}}{\text{Return}}$

100/40 = 2.5 (years)

Life Cycle Cost Analysis

System Life (i.e. 10 years)

(Cost of Materials + Labor + Services) – Rebates / (Energy Savings per year + Deferred Maintenance per Year)



To be expressed factoring Time Value of Money

Simplified10 Year Financial Plan Sample

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%										

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

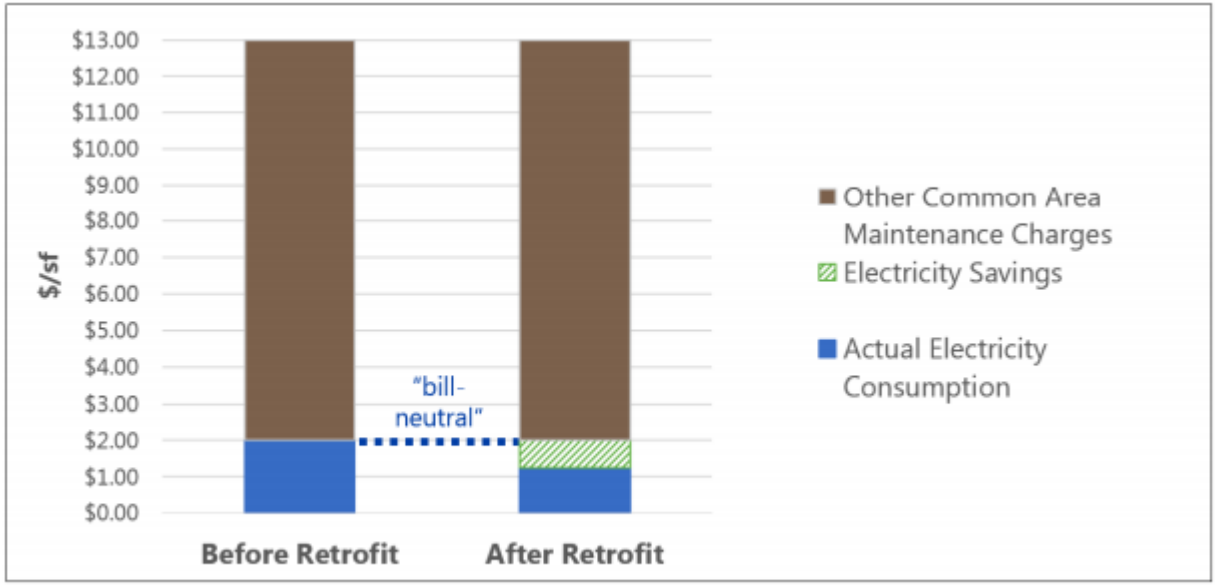


Figure 1. Example of Tenant Bill Neutrality

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

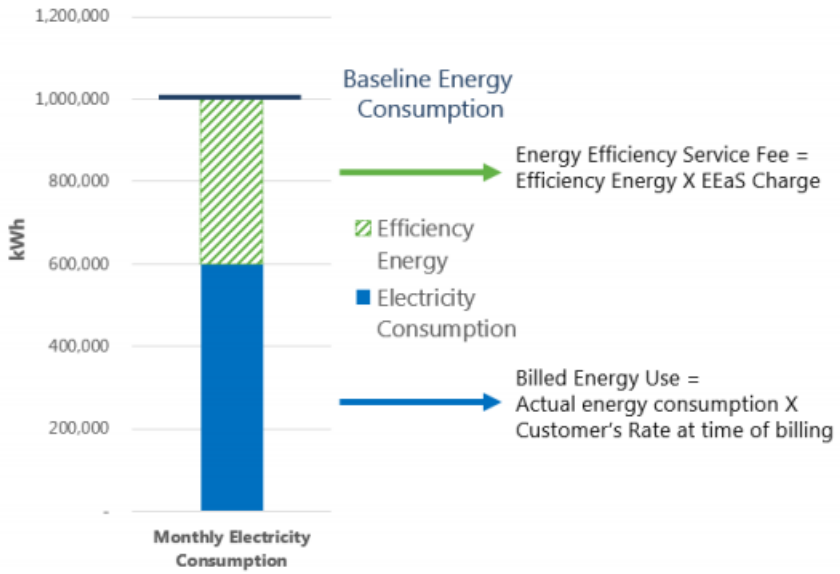


Figure 3. Basis of EEaS Seattle City Light Charges

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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

What are good strategies to combat budget shortages?

Pause for Questions

Keep it Simple, Students! – Solid Communication

Sequence of Operations – Controls Schedule

ARCHITECTURAL LIGHTING CONTROL SYSTEM LEGEND

DEVICE	DESCRIPTION		NOTES
ALCS	DISTRIBUTED INTELLIGENT ARCHITECTURAL LIGHTING CONTROL SYSTEM		DESCRIBES OVERALL SYSTEM INCLUDING SERVER, REQUIRED SOFTWARE PACKAGES, AND GENERAL ARCHITECTURE OVERVIEW.
LC-1	WALL STATION - 4 BUTTON PRESET PLUS OFF WITH RAISE LOWER		MOUNT ON WALLS FOR USER INTERFACE. COORDINATE PRECISE PLACEMENT WITH INTERIORS.
LC-2	WALL STATION - 2 BUTTON PRESET ENTRY ON/OFF		MOUNT ON WALLS FOR USER INTERFACE. COORDINATE PRECISE PLACEMENT WITH INTERIORS.
LC-3	WALL STATION - 5 BUTTON ZONE OVER-RIDE TOGGLE STATION		MOUNT ON WALLS FOR USER INTERFACE. COORDINATE PRECISE PLACEMENT WITH INTERIORS.
LC-4	WALL STATION - 4 ZONE PRESET PROGRAMMING STATION		MOUNT ON WALLS FOR USER INTERFACE. COORDINATE PRECISE PLACEMENT WITH INTERIORS.
LC-5	NOT USED		
LC-6	NOT USED		
LC-7	NOT USED		
LC-8	NOT USED		
LC-9	NOT USED		
LC-10	AV INTERFACE; RS232 AND ETHERNET		MOUNT IN UNOBTRUSIVE LOCATION NEAR TO AV EQUIPMENT REQUIRING COMMUNICATION WITH LIGHTING CONTROLS.
LC-11	CLOSURE COMBINE PARTITION SENSOR		MOUNT TO EITHER SIDE OF MOVEABLE ROOM PARTITIONS AS REQUIRED. PROVIDE IN CONJUNCTION WITH TYPE LC-11 CONTACT CLOSURE INTERFACE AND GRX-12V POWER SUPPLY AS REQUIRED.

ARCHITECTURAL LIGHTING CONTROL SYSTEM LEGEND

DEVICE	DESCRIPTION		NOTES
LC-12	DRY CONTACT CLOSURE INTERFACE		MOUNT IN UNOBTRUSIVE LOCATION NEAR TO EQUIPMENT REQUIRING DRY CONTACT CLOSURE TRIGGER FROM ARCHITECTURAL LIGHTING CONTROL SYSTEM.
LC-13	DMX SHOW CONTROLLER		TO BE LOCATED IN FIRST FLOOR ELECTRICAL ROOM. SIZE AS REQUIRED. INTERFACE TO TALK TO ARCHITECTURAL LIGHTING CONTROL SYSTEM.
OS-PIR	CEILING OR WALL MOUNTED PASSIVE INFRA-RED OCCUPANCY SENSOR		MOUNT IN CEILINGS OR ON WALLS AS SHOWN ON DRAWINGS AND IN AREAS IN WHICH OCCUPANCY SENSING IS REQUIRED AN LINE OF SIGHT TO DEVICE IS NOT OCCLUDED.
OS-DT	CEILING OR WALL MOUNTED ULTRASONIC OCCUPANCY SENSOR		MOUNT IN CEILINGS OR ON WALLS AS SHOWN ON DRAWINGS AND IN AREAS IN WHICH OCCUPANCY SENSING IS REQUIRED AND LINE OF SIGHT TO DEVICE MAY BE OCCLUDED, E.G. RESTROOMS.
LC-PC	DAYLIGHT SENSOR		MOUNT IN CEILINGS AS SHOWN ON DRAWINGS IN AREAS IN WHICH DAYLIGHT RESPONSIVE DIMMING IS REQUIRED.
LC-PP	PROCESSOR PANEL DIGITAL SYSTEM HUB.		MOUNT IN ELECTRICAL CLOSETS AS APPROPRIATE. PROVIDE QUANTITIES AND LOCATIONS AS REQUIRED TO PROVIDE ADEQUATE COMMUNICATIONS WITH ALL POWER PANELS AND INTERFACE DEVICES.
LC-SM	DISTRIBUTED RELAY SWITCHING MODULE WITH O-10V DIMMING CAPABILITY		MOUNT IN REMOTE LOCATIONS AS APPROPRIATE. PROVIDE SIZES AND CONFIGURATIONS AS REQUIRED TO HANDLE ANTICIPATED CONTROL ZONE LOADS.

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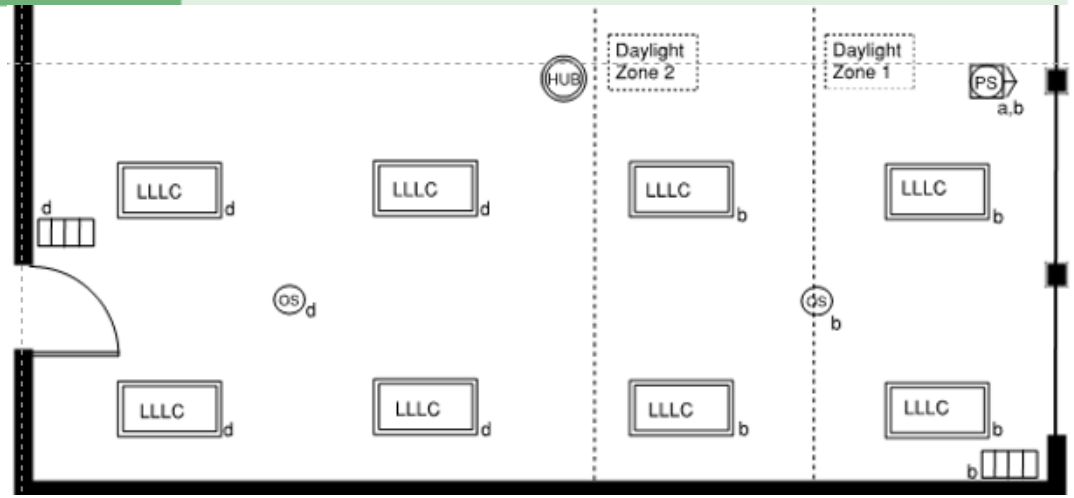
NLC Key Collaboration Tool: **Sequence of Operations**

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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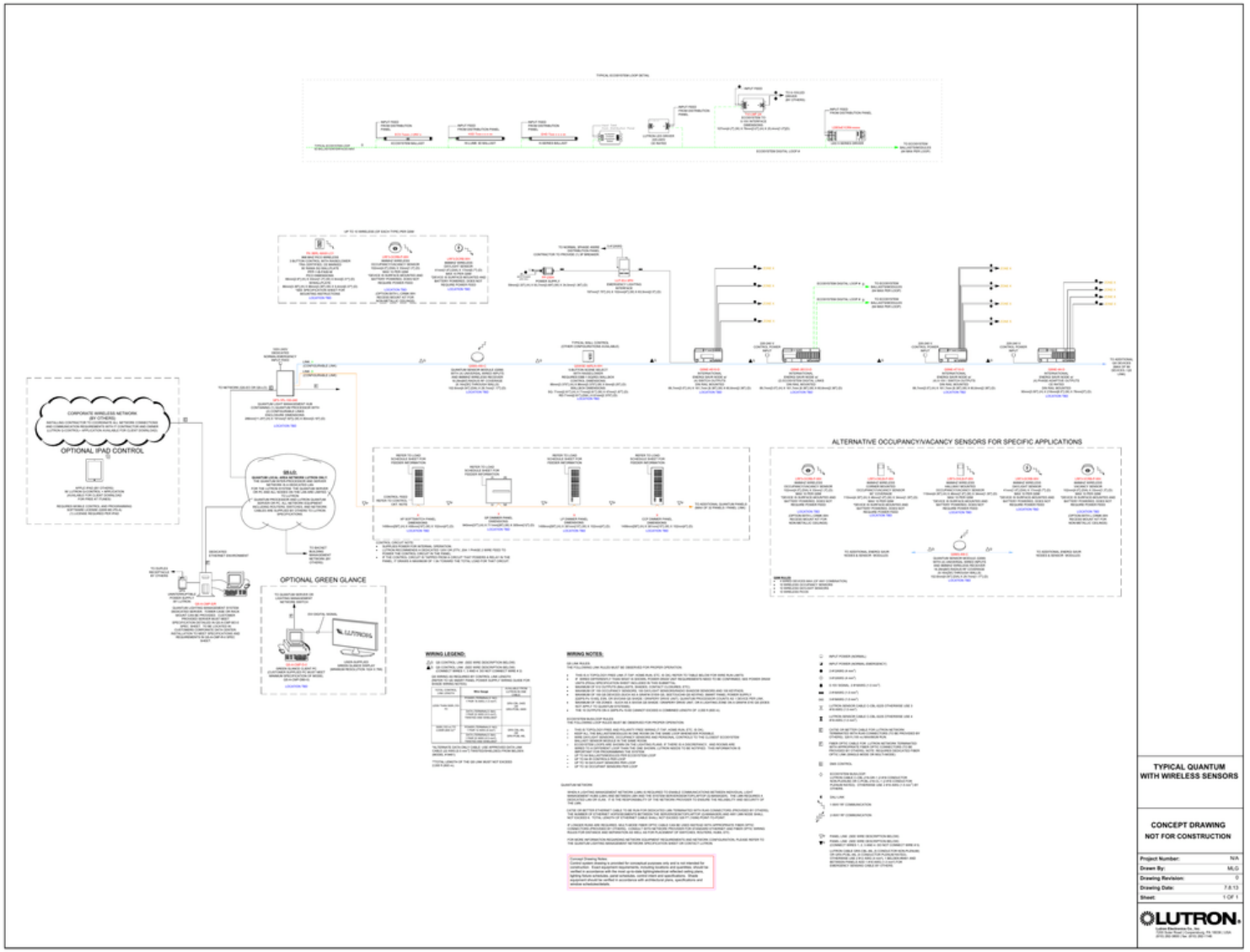
One Line Docs for EC and Facilities

- Location specific hardware and connections
- Bonus to developing these and SOO early
  - Pre-commissioning / packaging



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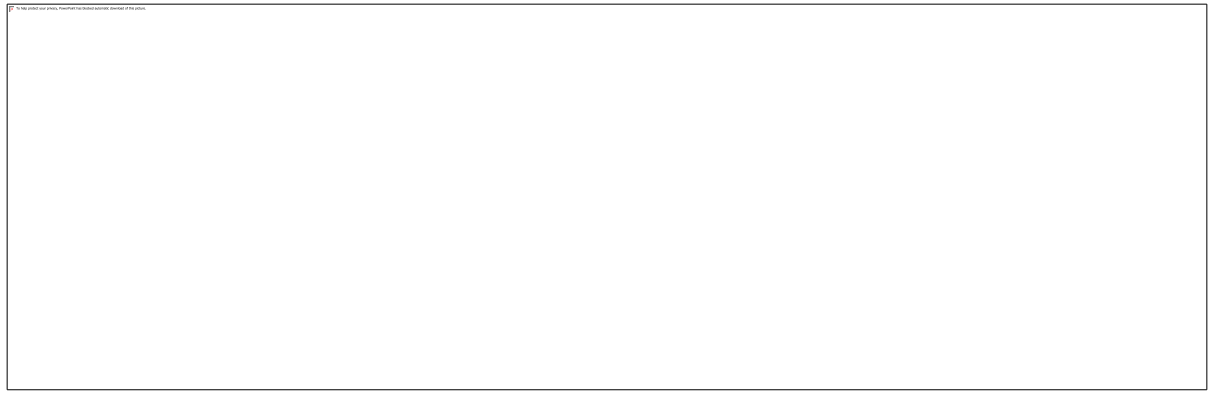
Key for Tenants: Wall Stations

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



Programming Apps and Commissioning Tools

- Many systems today are configurable by smart device app – not just for lighting.
- These apps may all be downloaded to your phones or tablets

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

Ensure There is System Training – Specs Sample

Basis of Design:

- Division 260943
  - Lighting System Specs
  - Contractual Document

D. Manufacturer's factory service representative will instruct Owner for a minimum of sixteen (16) (less for smaller systems) hours coordinated with owner's schedule.

1. System capabilities.
2. System programming.
3. General operations.
4. Maintenance.
5. Replacement parts.
6. Available support.
7. Warranty.

Important Questions to ask about Warranty

- How long has the manufacturer been in business?
- How long will the manufacturer be in business?
- Longer warranties cost more $$ with reputable manufacturers

B. WARRANTY

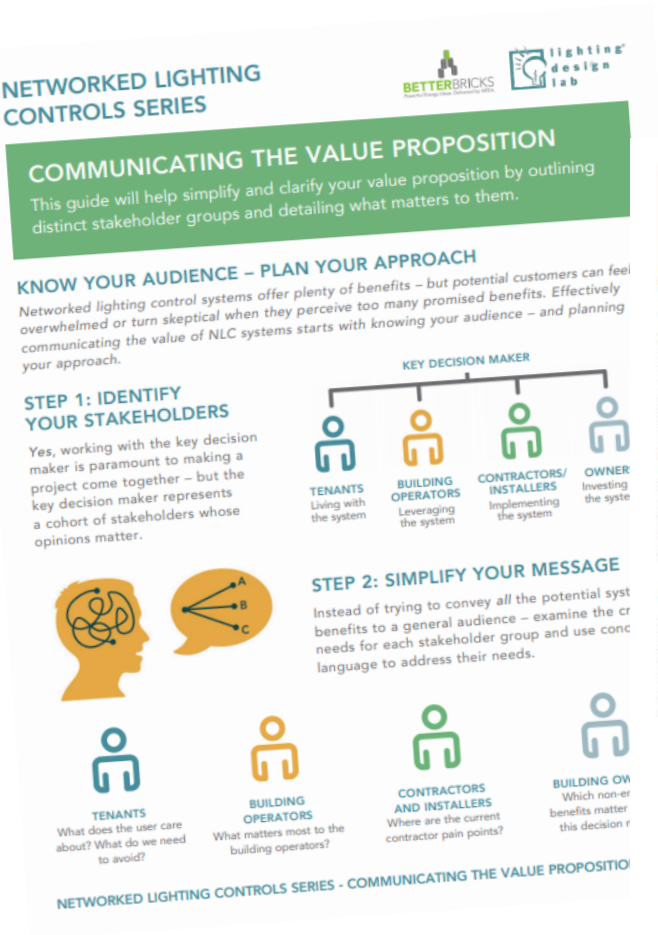
1. Provide system manufacturer's warranty covering three (3) (or 2 or 5 – note longer warranty is more costly year parts and labor and ten (10) year limited parts warranty to repair and replace defective equipment.
2. Manufacturer will:
   a. Maintain a standard stock of all spare parts for installed system for a minimum of ten (10) years from the date of system turn over to owner.
   b. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
   c. Provide on-site service support within 48 hours.

LDL as a Resource: Education & Market Development

LDL's Flagship Workshops

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

LDL as a Resource: NLC / LLLC Best Practice Guides and Video



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.

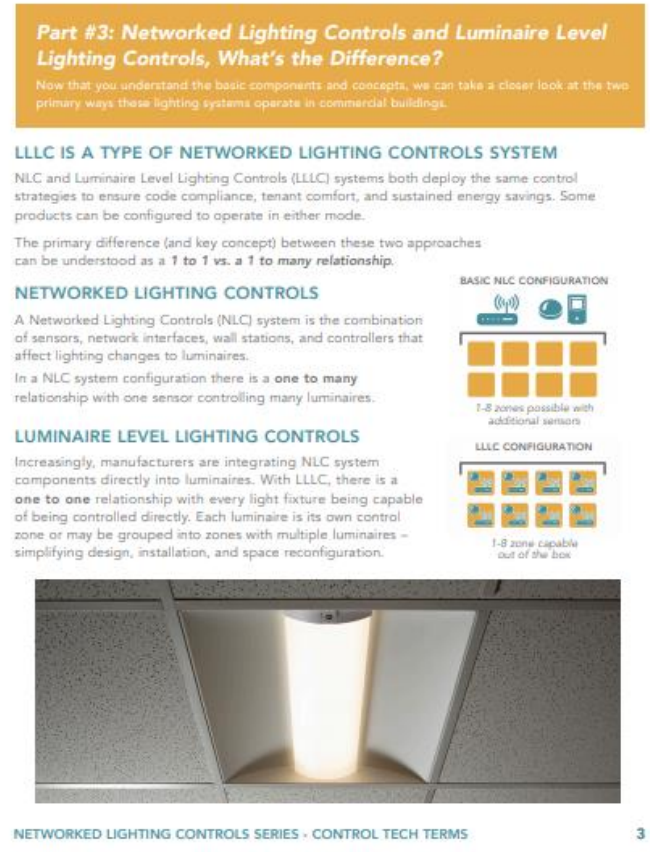
TENANTS
What does the user care about? What do we need to avoid?

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 two primary ways these lighting systems operate in commercial buildings.

LLLC IS A TYPE OF NETWORKED LIGHTING CONTROLS SYSTEM

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

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

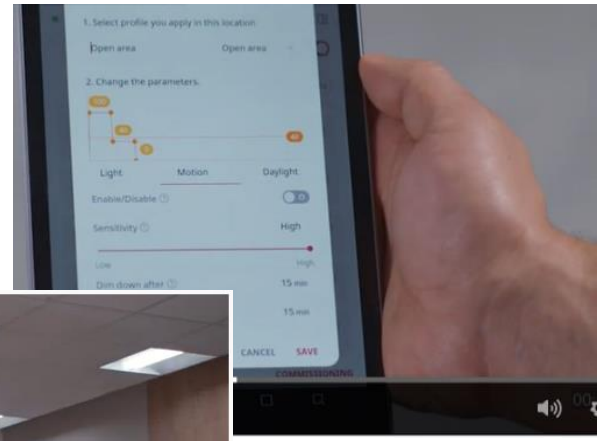
LUMINAIRE LEVEL LIGHTING CONTROLS

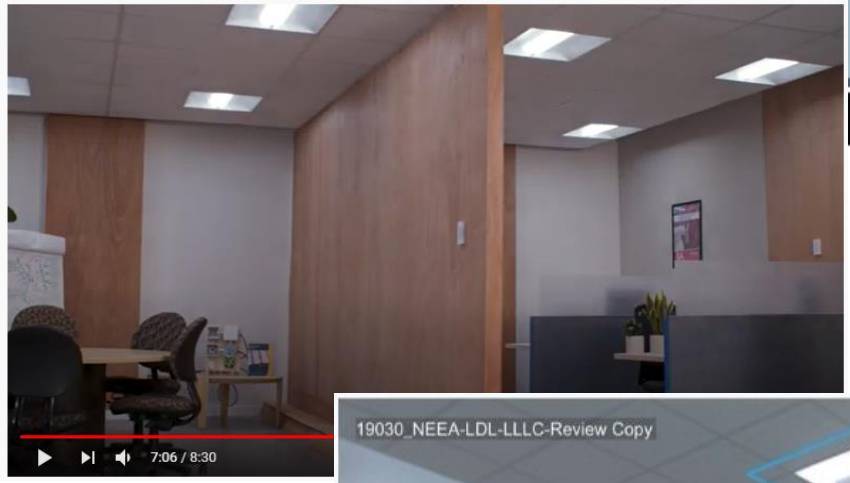
Increasingly, manufacturers are integrating NLC system components directly into luminaires. With LLLC, there is a **one to one** relationship with every light fixture being capable of being controlled directly. Each luminaire is its own control zone or may be grouped into zones with multiple luminaires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

LLLC CONFIGURATION

1-8 zone capable out of the box

NETWORKED LIGHTING CONTROLS SERIES - CONTROL TECH TERMS 3





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

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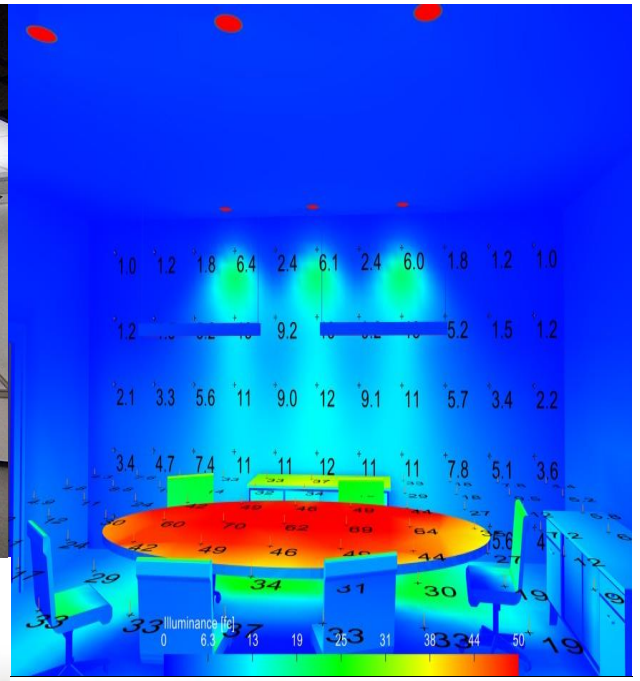
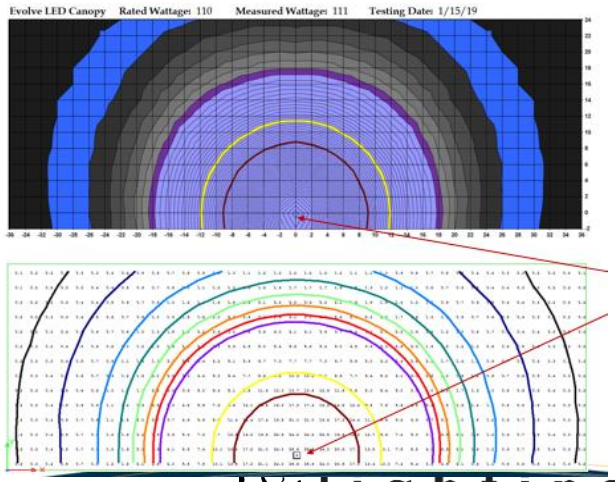
LDL as a Resource: Project Specific Consults



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



Pause for Questions

And now – a few words from LDL

Upcoming LDL Online Events

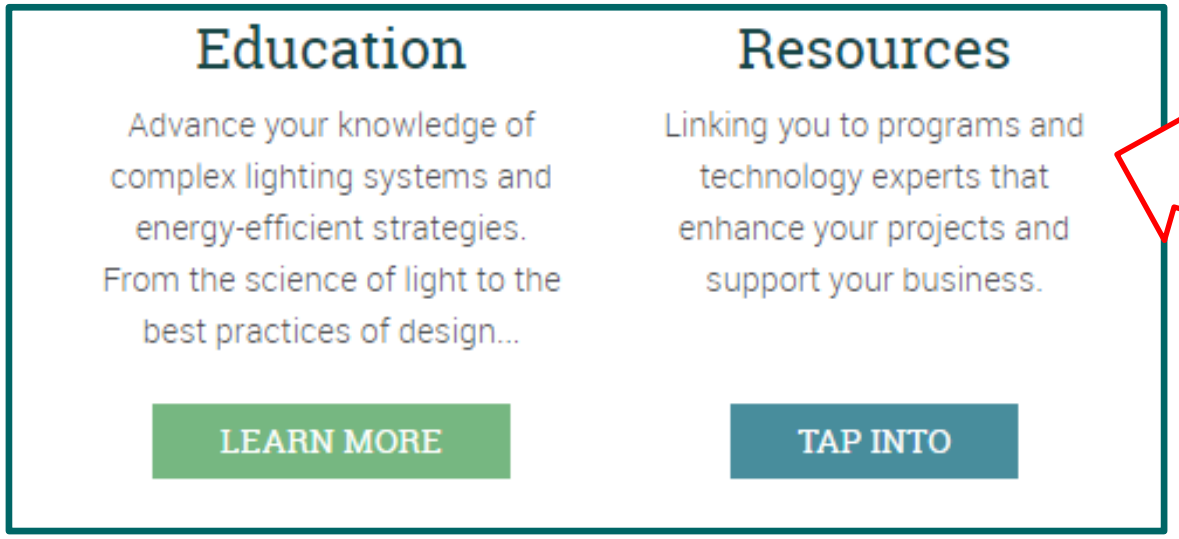
LDL Course	Delivery Date	Time
NLC Ux Findings Webinar	12/15/2021	10am - noon

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

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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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