



STAKEHOLDER MEETING 2018

July 9 - 11 • Boston, MA

NLCs in Action: The Good,
The Bad, and The Awesome

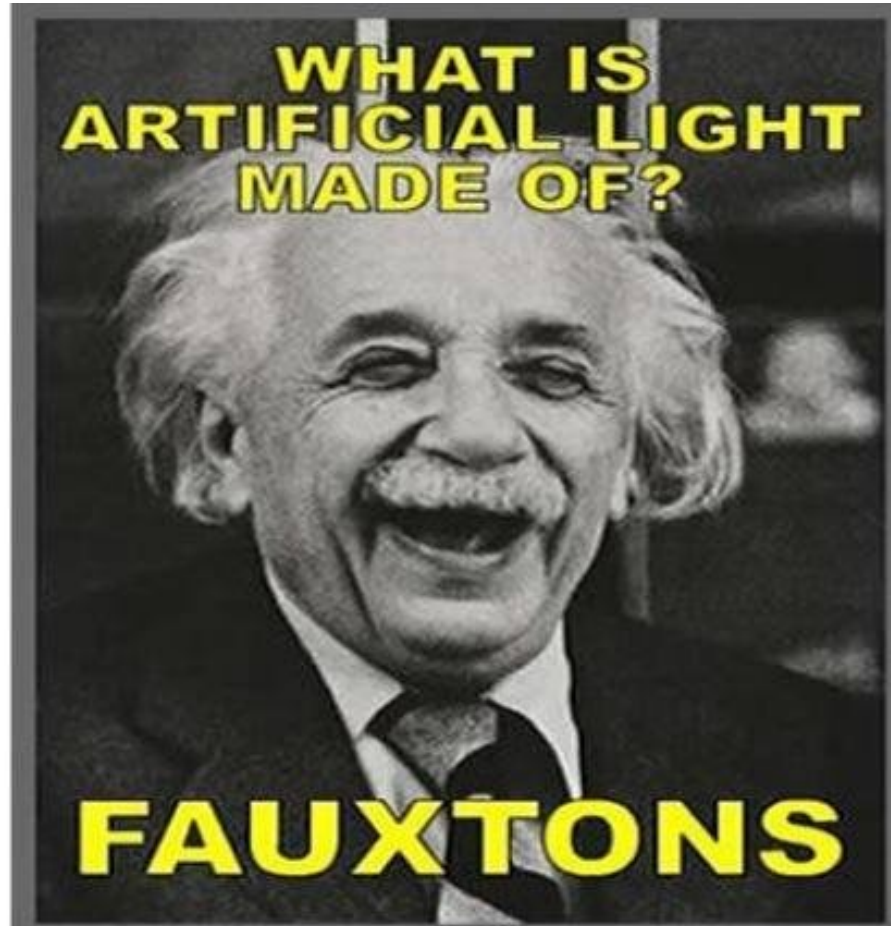
Question

When you do daylight harvesting, you dim down the artificial (electric) lights in response to natural light (daylight) to save energy and money and maintain consistent light levels in the space.



What is artificial light made of?

Answer

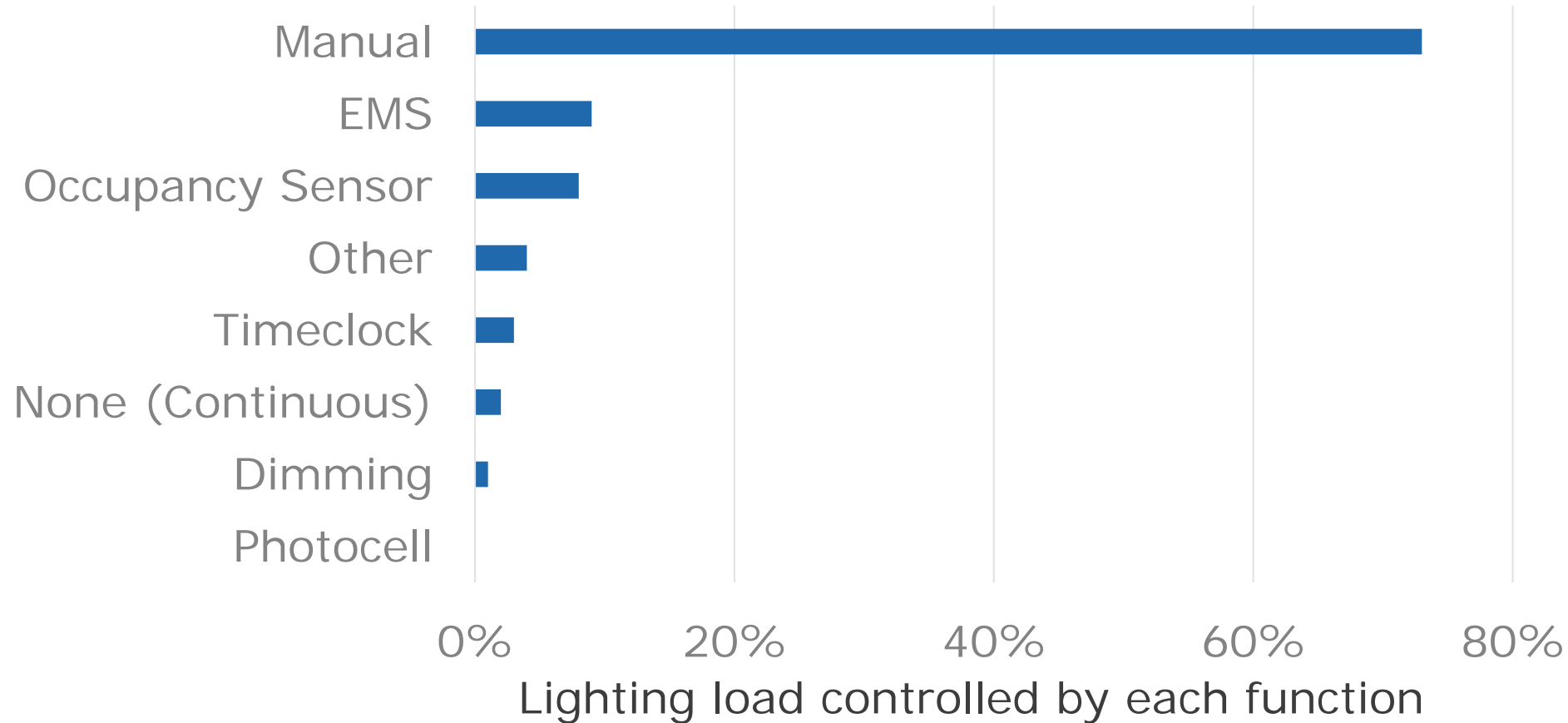




NLCs – What are they and what can they do?

What can the system do?	
Networked	Scheduling
Wired, Wireless, or Both	Personal control
Occupancy-sensing	Demand Response
Daylight-harvesting	Non-lighting plug-load control
Adjustable for high-end trim	Zoning
Address individual luminaires	Luminaire-level control (field)
Luminaire-level lighting control	Continuous (100+ steps) dimming
Local processing	Energy monitoring
BMS/HVAC/etc integration	Remote diagnostics
Emergency lighting integration	Tunable white lighting

NLC not yet widely adopted



2014 Commercial Building Stock Assessment, Pacific Northwest, NEEA

Barriers to NLC Adoption

- Poor past experiences
- Requires training
- Compatibility issues
- Not standardized
- Unclear savings
- High costs





Full Scale Adoption of Networked Lighting Controls

The Good News

- Technology is changing and improving... FAST!
- Systems designed from the ground up to reduce complexity and cost
- Easier to install, setup, use than ever before
- “Goof-proof”, with low-cost adjustments that make callbacks cheaper
- New system capabilities that provide new value to customers



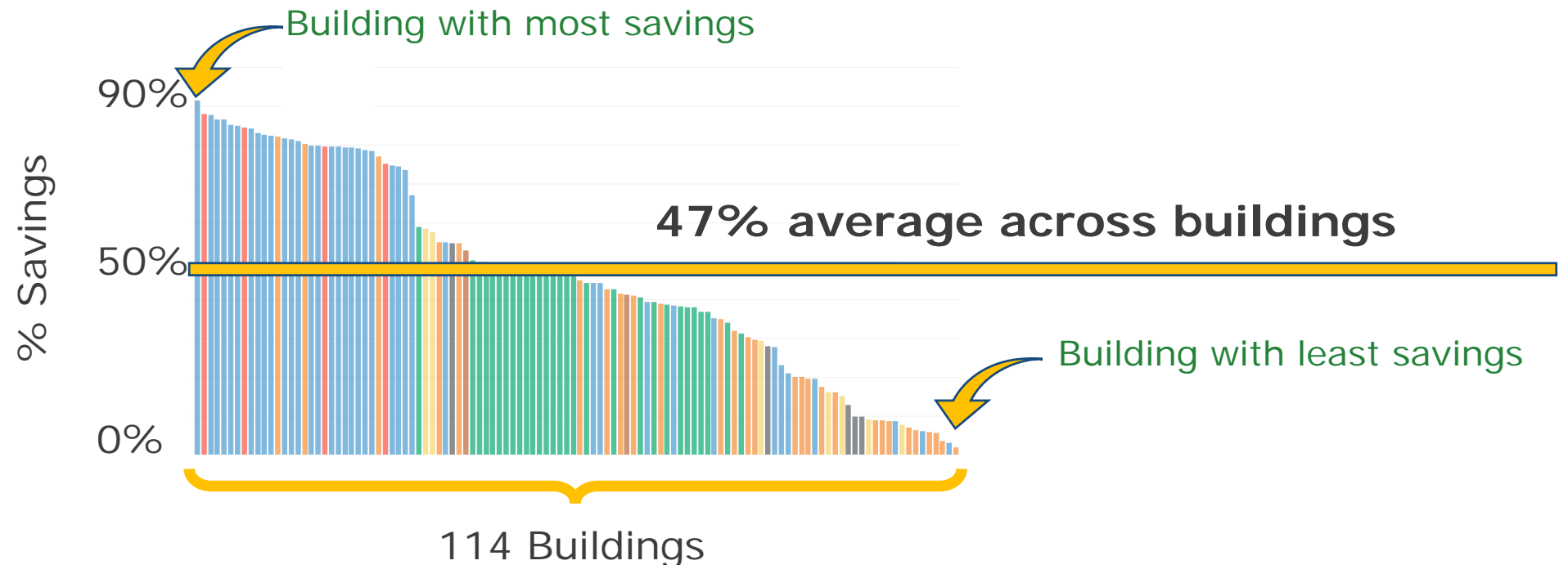
Staples

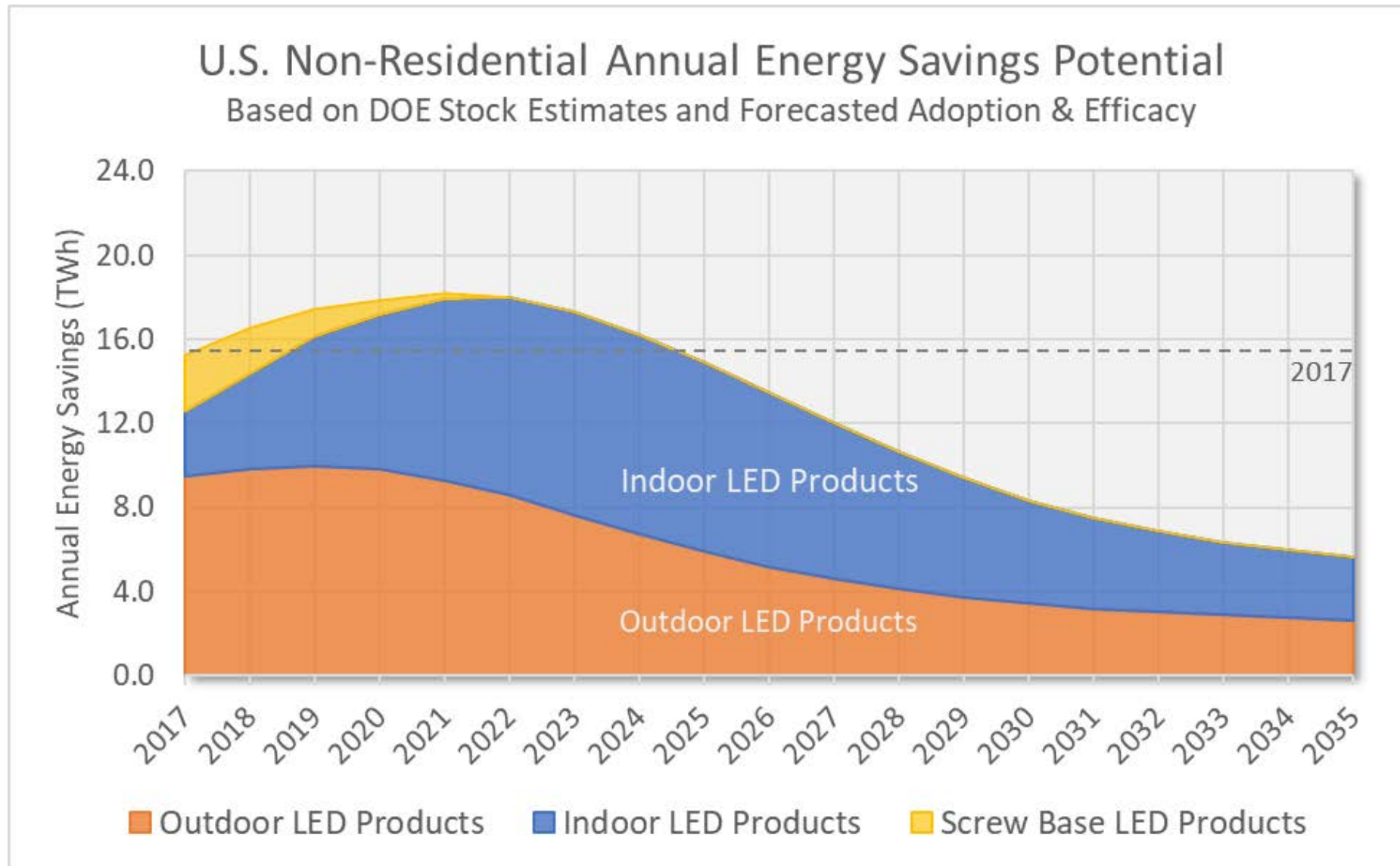
Four Technology Innovations Reduce Install Complexity, Add Value

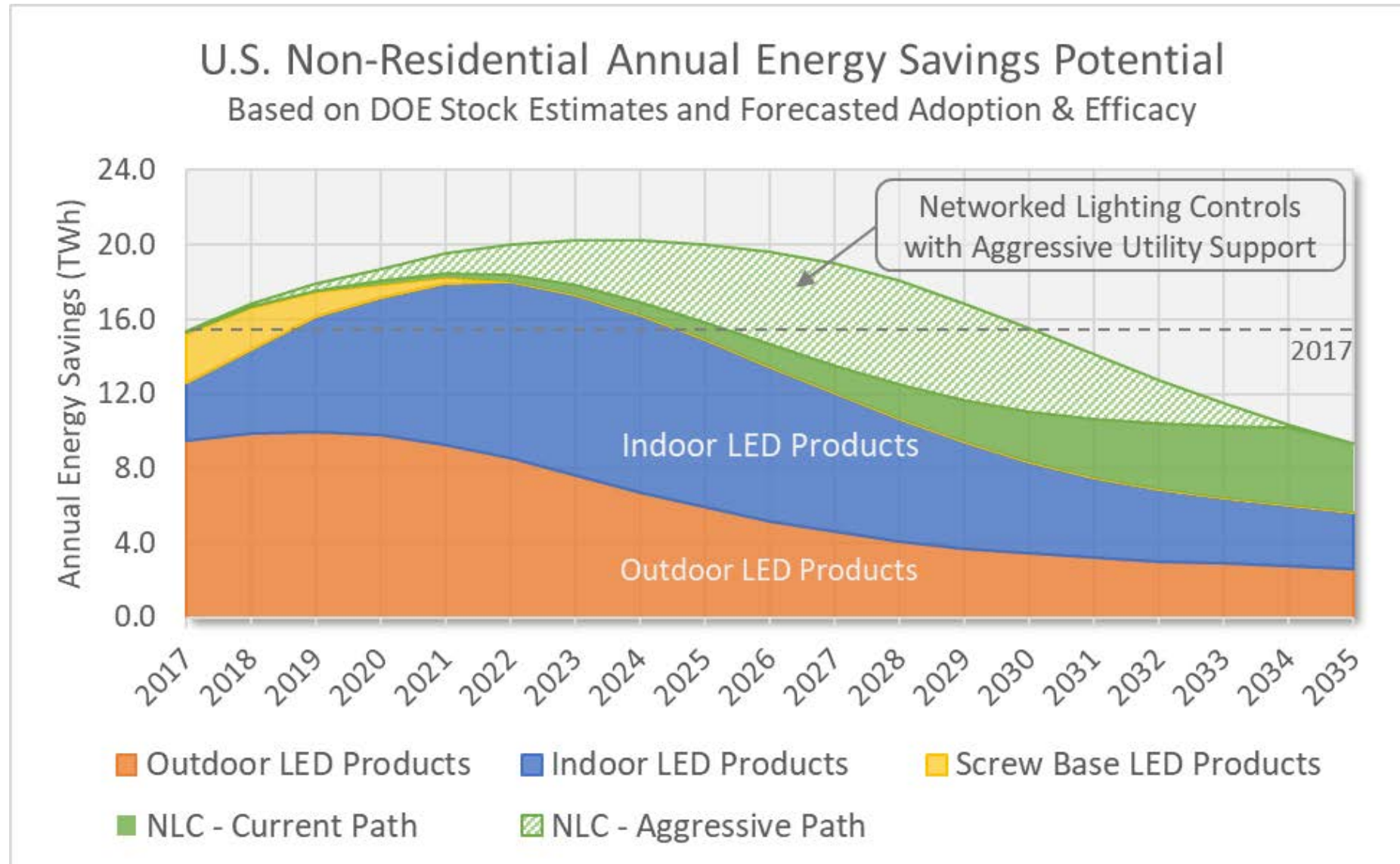
1. Integrated or “Embedded” Sensors and Controls
2. Wireless
3. Apps or Software-based Tools to Configure the System
4. Integrated Power Meters

Significant Energy Savings

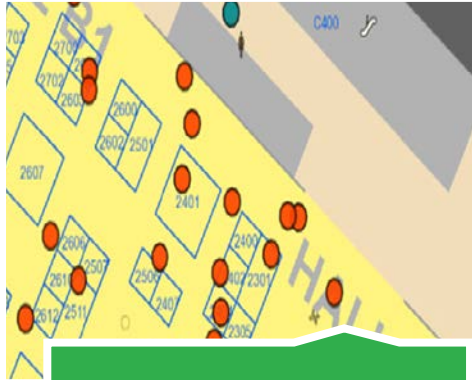
- Average savings in lighting energy from lighting controls: 47%
- Data from voluntary contributions
- Individual buildings: lighting control savings from 2% to 90%
- Search “DLC Energy Savings Report” online to download the full report and webinar
- Other utility auditing groups are beginning to confirm similar values to this report’s averages



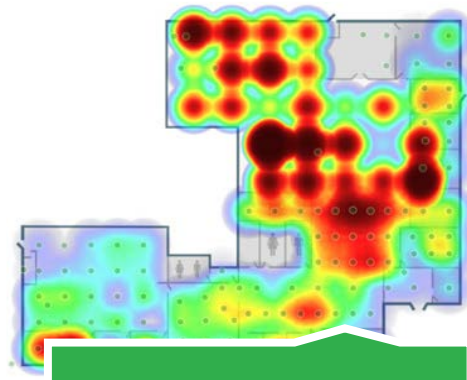




New Capabilities Beyond Energy



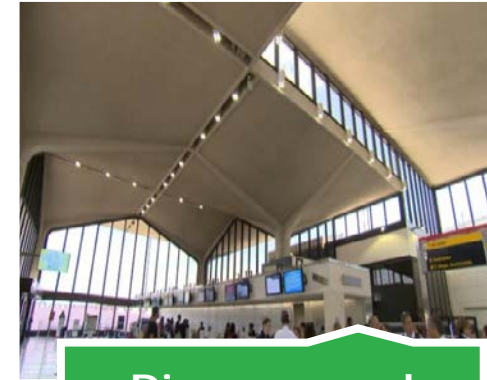
Asset Tracking



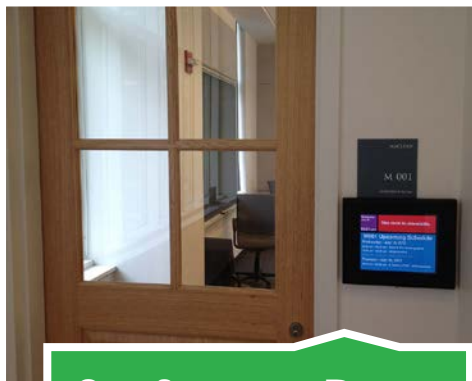
Space Utilization



Indoor Positioning



Diagnose and Report



Conference Room Scheduling



Security



Energy Tracking



Integrate with BMS/HVAC

Today's Panel

- What do we need to be aware of to ensure seamless installation, programming, and operation?
- What are some remarkable examples of well implemented systems?
- What does the future hold?

Panelists



**Kandice
Cohen**

*Bright Light
Energy
Consulting*



**Ruth
Taylor**

*Pacific
Northwest
National Labs*



**Elijah
Ercolino**

*Boston
University*



**Rahul
Shira**

*Philips
Lighting*



**Next
Generation**
LIGHTING SYSTEMS

Connected Lighting Installations

LEARNING FROM WATCHING

Ruth Taylor

Pacific Northwest National Laboratory

DLC Stakeholder Meeting

July 11, 2018

What We'll Cover Today

- What NGLS is all About
- Current Evaluations
- Communication
- Recommendations
 - Utility Program Managers
 - Specifiers
 - Manufacturers
- Future Evaluations



Illuminating
ENGINEERING SOCIETY

INTERNATIONAL ASSOCIATION OF LIGHTING DESIGNERS

IALD

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

BUILDING TECHNOLOGIES OFFICE

Steering Committee and Advisors

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The Lighting Education Institute

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KCL Engineering

Nathan Mitten
Senior Manager of Property Standards &
Improvements
Kimco Realty Corporation

Dan Blitzer, FIES
Practical Lighting Workshop



SMUD™



conEdison, inc.

- Gabe Arnold - DLC, NLC
- Dave Bisbee - SMUD
- Peter Jacobson - Con Edison
- Levin Nock - DLC, NLC
- Michael Poplawski - PNNL/DOE
- Chris Wolgamott - NEEA

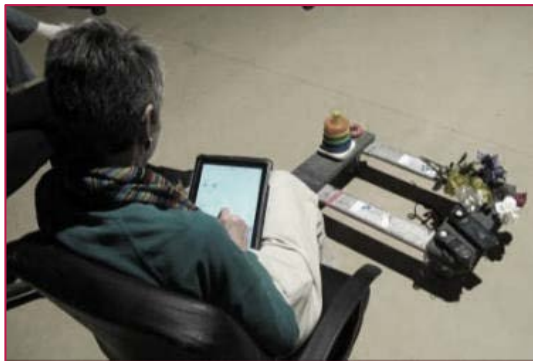
Choosing the New NGL Direction

- What are the primary barriers to connected lighting?
- Where can NGL make a difference?
- What can NGL do that others can't?



Building on NGL History

- Long history of trust and respect from manufacturers and specifiers
- Highly respected, engaged and committed Steering Committee
- Extensive experience developing technical requirements and evaluation protocols/processes
- Subjective evaluations are key to observing configuration complexity



Configuration Complexity

- Systems that are overly complicated and time-consuming to configure have historically delivered less than ideal performance.
- Reduced configuration complexity increases the likelihood that deployed lighting controls will be correctly and consistently operating, increasing the persistence of energy savings.
- Broad deployment of connected lighting systems will require system configuration complexity to be well-matched to owner/occupant capabilities, greatly simplified, or effectively removed.



Role of Subjective Evaluations

- How can configuration complexity be evaluated?
- What needs to be modified for a system to be used by a broader audience?
- What are the root causes of confusion and how are they different for different types of users?



Evaluating Configuration Complexity

To find the real 'pressure points', *people* need to observe and evaluate the *people* installing and configuring the system in real time, without assistance - it just can't be done in a demonstration, mock-up, or testing lab.

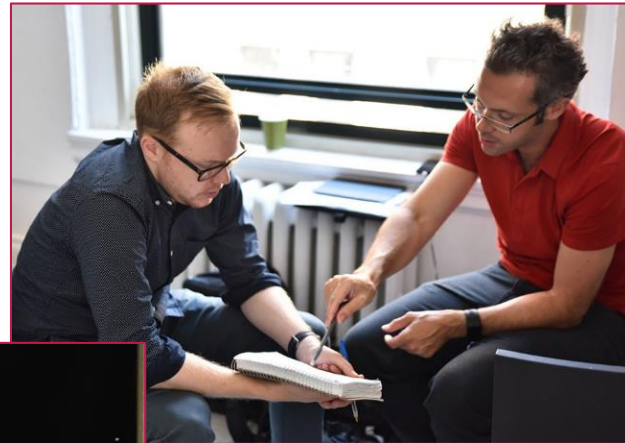


Starting by Narrowing the Scope

- Focus on one application
- Start with 'easy', 'out of the box' systems and build from there
- Separate judging events to individual evaluations
 - Installation and Configuration
 - Performance
 - User Acceptance

We needed to come away with tangible, actionable recommendations, not just anecdotal advice.

Onsite Manufacturer Participation



Participation Must be a Win Win

- What system developers give:
 - Substantial staff time in preparing and submitting entries
 - Product itself
 - Risk of negative exposure
- What system developers get:
 - Unbiased, specific feedback
 - Opportunity to observe and learn from installations
 - See how their approach compares to others

Participating Manufacturers

Installation One – July 2017

Company	Control System	Luminaire
Lumenwerx	Magnum	Reven SIB
Selux	Easy Sense	M36 D-1
Crestron	Zum	Starfire Versalux D-I
Philips Lighting	SpaceWise DT	Sona
RAB Lighting	RAB LightCloud	Swish 2x2
Cree	SmartCast	CR22
Nextek Power Systems	Sky Control	Independence iLED R Series

Installation Two – January 2018

Company	Control System	Retrofit Kit
Philips Lighting	SpaceWise DT	EvoKit Troffer Retrofit Kit
Lutron Electronics	Vive	Orion Ison Retrofit Modular
Acuity Brands	nLIGHT AIR	BLT Relight Series Kit
Eaton	WaveLinx	Metalux Cruze LED Retrofit Kit
LG Electronics	Sensor Connect	Simple Choice Retrofit Kit



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LIGHTING SYSTEMS

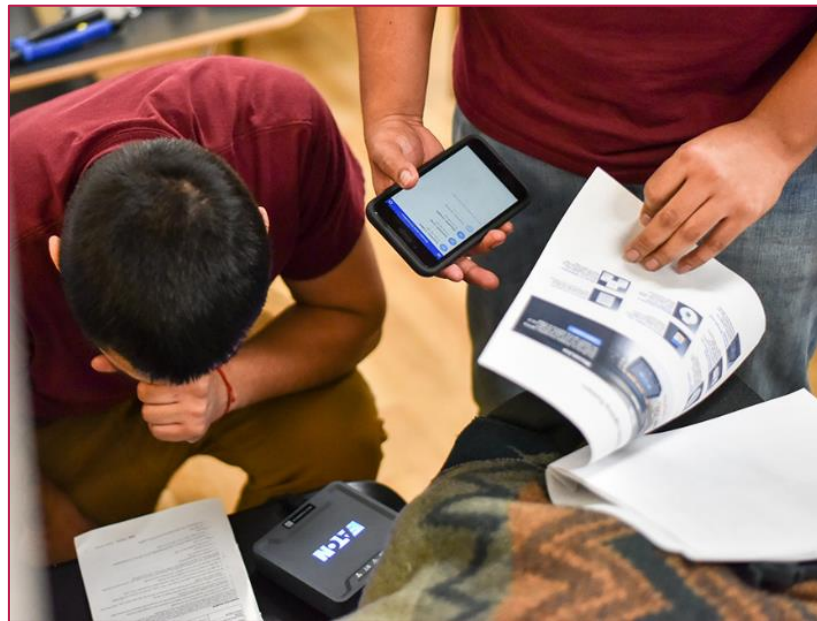
Characterizing the Systems

Different Approaches

- Partnerships vs. proprietary solution
- Pre-configuration/ re-configuration
 - Tools (remote, phone, computer)
 - Level of assistance needed/assumed
- Number and types of components
 - Wall Controls
 - Sensor placement
 - Use of wiring

System Characterization by Approach

- Entries can be characterized by how entrants approached:
 - System Architecture
 - Operational Complexity
 - Configuration Tools
 - Wall Controls
 - Documentation and Instructions



System Architecture

	Least Complex (7)	Moderately Complex (2)	Most Complex (3)
Components	Luminaire-integrated sensor and control	Luminaire-integrated sensor and control	Remote mounted sensor and control
	Wall switch	Wall switch Local area network device	Wall switch
Connection	Wireless	Wireless	Wired Wireless PoE

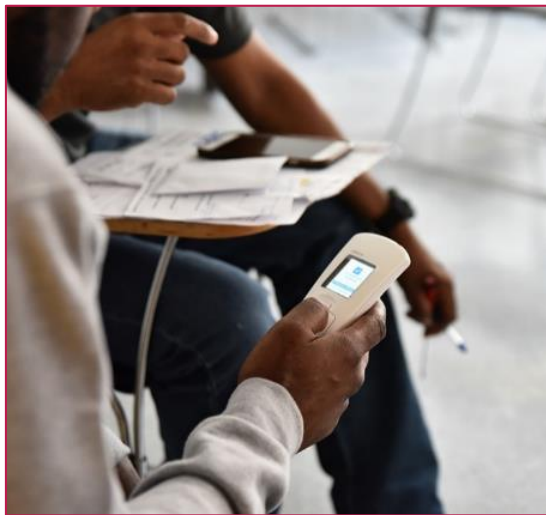


- NGLS required minimum set of capabilities appropriate for “easy” systems
 - Occupancy/Vacancy sensing
 - Local on/off
 - Daylight harvesting
 - Manual continuous dimming
 - High-end trim/task tuning
 - Zoning
 - Field-adjustable control settings
- All submitted systems met minimums, some provided additional capabilities

Initial Startup Approach

Pre-configured out-of-the box operation	Onsite pairing of luminaires to wall switches Factory-set default operational settings	Onsite pairing of luminaires to wall switches Various additional steps Factory-set default operational settings	Onsite pairing of luminaires to wall switches Onsite configuration of external daylighting and occupancy sensors
2	4	3	2

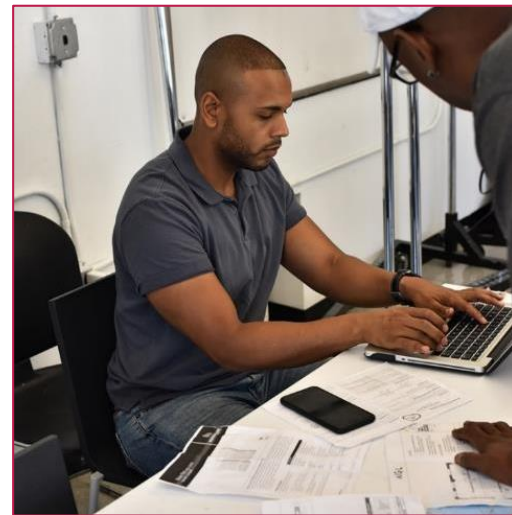
Configuration Tool Categories



Handheld Tool
(1)



Phone App
(8)



Computer Front-end
(3)

Wall Control Categories



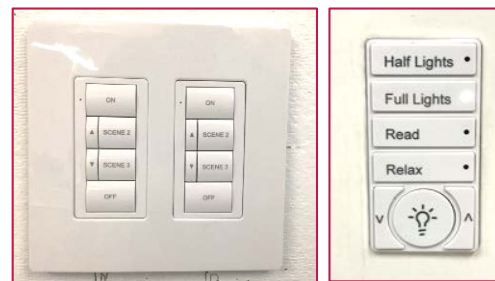
Pre-configured Rocker Switch
(5)



Pre-configured Multi Button Switch
(3)



Site Configurable Rocker Switch
(2)



Site Configurable Multi Button Switch
(2)



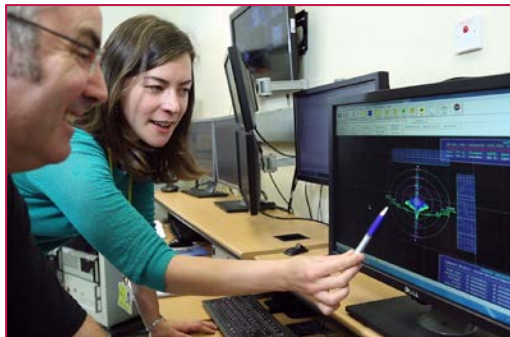
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Communication

The single biggest problem in
communication is the illusion
that it has taken place.

George Bernard Shaw

- We all speak a different language.
 - Designers
 - Product & IT Engineers
 - Contractors



Question

How many programmers does it take to change a light bulb?



How many programmers does it take to change a light bulb?

None, that's a hardware problem.

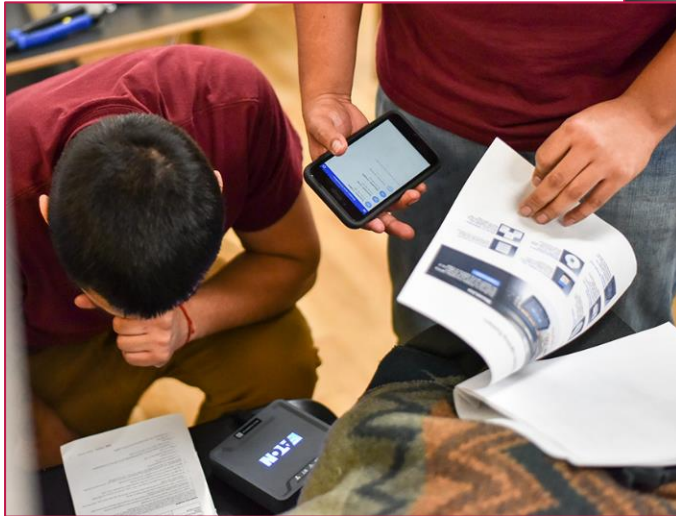
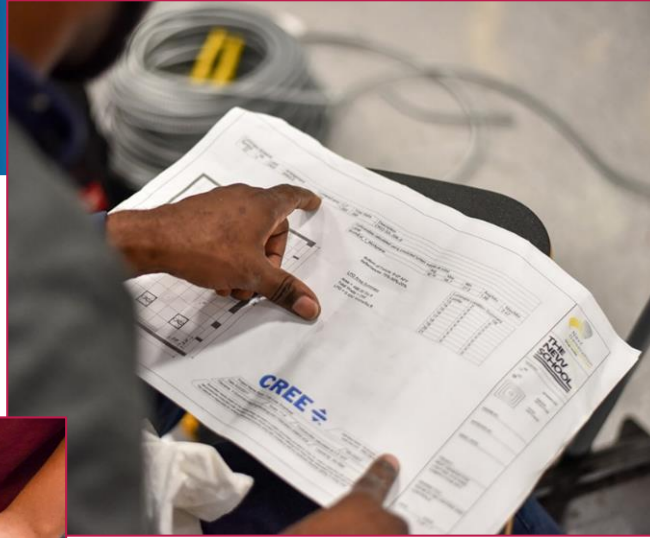


Vocabulary In the Field

<https://energy.gov/eere/ssl/next-generation-lighting-systems-competition-one-installation-video-terminology>



Documentation



Documentation

<https://energy.gov/eere/ssl/next-generation-lighting-systems-competition-two-installation-video-documentation>





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Recommendations

- Consider developing template specifications for customers interested in simple lighting control systems
- Consider collaborative efforts with manufacturers to address documentation issues
- Consider requiring contractors to complete lighting controls training in order to be eligible for incentives or develop
- Collaborate with other stakeholders, such as DLC, regional energy efficiency organizations and manufacturers, to deliver training

- Clear specification (not necessarily detailed) is critical
- Identify the “must haves” vs. “nice to haves”
 - Capability (good) comes at the price of complexity and cost
 - Simplicity and economy (good) come at the price of extended functionality
- Carefully review and respond to system submittals
- Choose an experienced installer (or one you trust to learn quickly)
- Require documentation and training on the system
- Consider Labeling the wall controls

- Test the product and installation guide with *installers* (not just your engineers)
- Use good illustrations and simple copy for installation guide
 - Create drawings as installer will see it during the install
- Installation guidance '*in the app*' is easier than reading it in print
- Installer's first impression is critical –the installation guide needs an overview.
 - Make it easy to find online videos (good for set up/install) and guides
 - Quick Set Up guide is important; defer complicated options for "advanced"
- Have a clear, reliable chain for tech support so installers can easily reach *someone who really knows!*

- Documentation
- Configuration Tools
- Sensors

Several manufacturers have planned follow-up visits with installers to get additional feedback on updates based on NGLS feedback.

Future Evaluations

- Updates to currently installed systems
- New indoor evaluations – interoperability, PoE ?
- Outdoor evaluations – parking lot systems, Virginia Tech Transportation Institute



What would you like to see?



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LIGHTING SYSTEMS

Thanks!

Deploying LEDs w/Controls at Enterprise Scale

July 11, 2018

Elijah Ercolino

Boston University

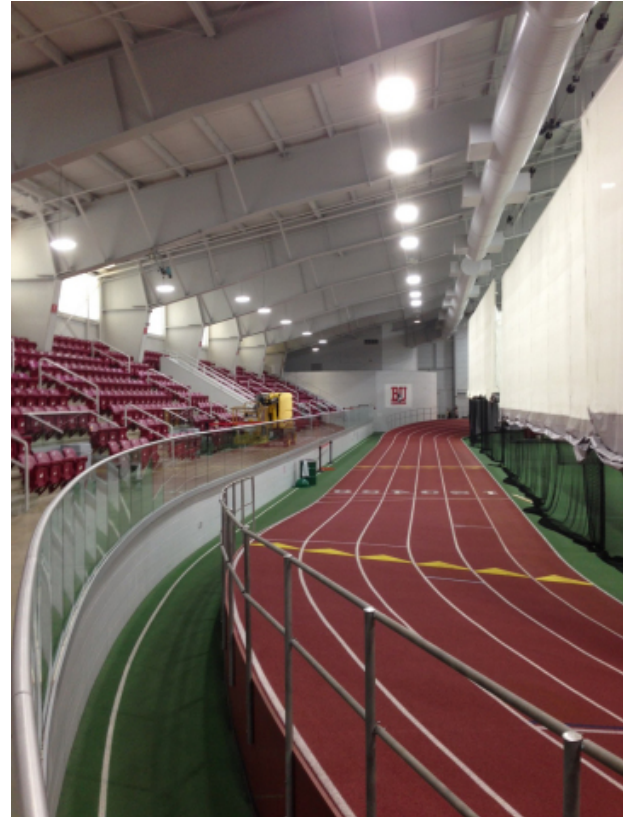
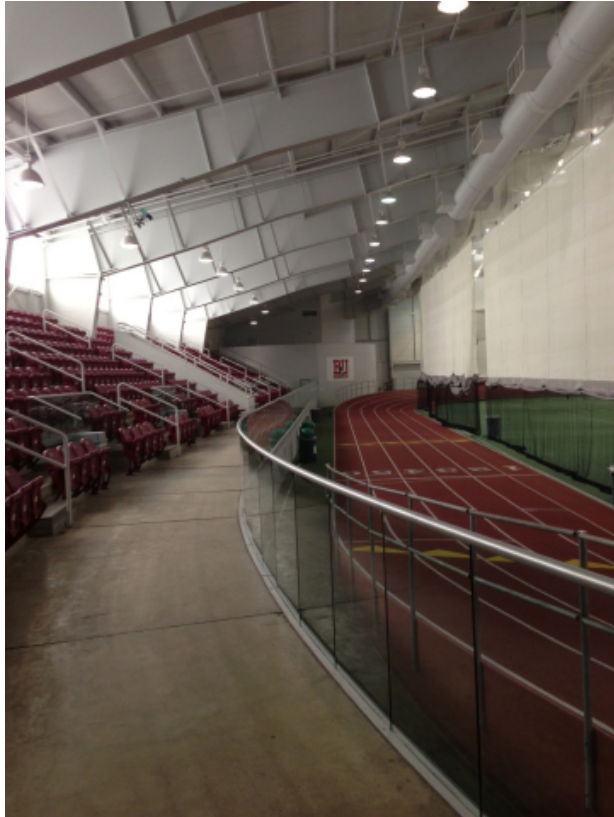
- One of the largest employers in Boston
- 15M square feet of Class A/B/C across CRC and MED
- 300+ Buildings
 - Laboratory and Medical Sciences
 - Division 1 Athletics
 - *Data Centers/Vivariums/Natatoriums/Theatres

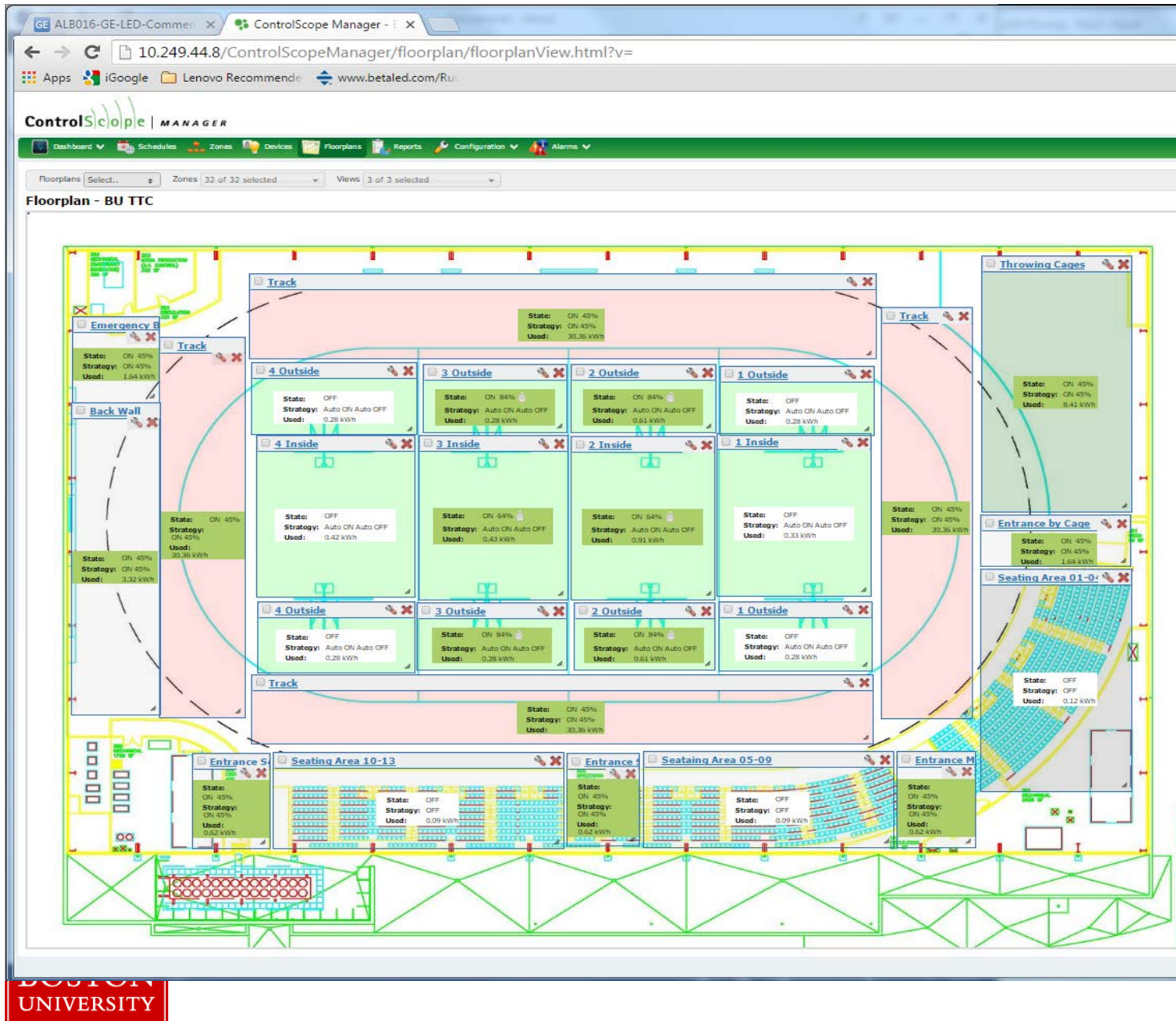
Energy Goals

http://www.bu.edu/climateactionplan/files/2017/12/ClimateActionPlan_Report_FINAL.pdf



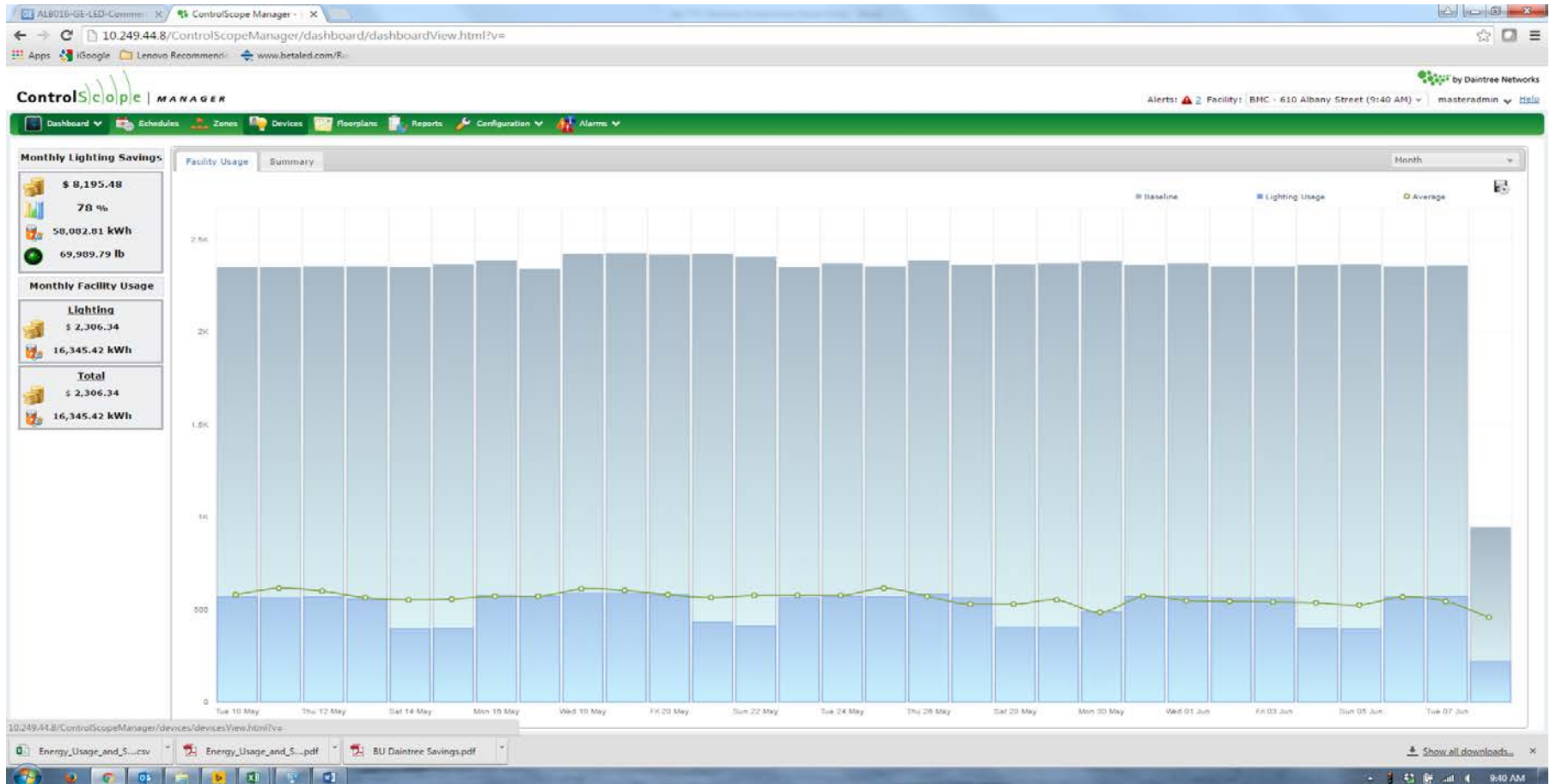
Tennis and Track Center





Parking Garages





Lab Science



But...we still have more to do!

- Installation
- Networking
- Life Safety/Building Automation/and Lighting Controls Nexus

Continued and Future Research

- ByteLight indoor location technology was recently acquired
- Broad Spectrum Lighting improvements
- Vampire load reductions of chatty/connected lighting

Heisenberg Principle

- Where are we?
 - Current penetration of controls in C&I buildings (*opportunity)
 - Technology advancement (*simplicity, simplicity, **simplicity***)
 - Real live installations
 - Innovation (design around *simplicity*)
- Where we are going?
 - Energy savings opportunity
 - Intelligent building landscape of the future (NEBs)



(R)evolution

