

# Lessons Learned in a Living Lab



Next  
Generation  
LIGHTING SYSTEMS

# NGLS Partners

INTERNATIONAL ASSOCIATION OF LIGHTING DESIGNERS

**IALD**



**Illuminating**  
ENGINEERING SOCIETY

U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy

BUILDING TECHNOLOGIES OFFICE

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Practical Lighting Workshop

# Connected Lighting Advisory Group

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

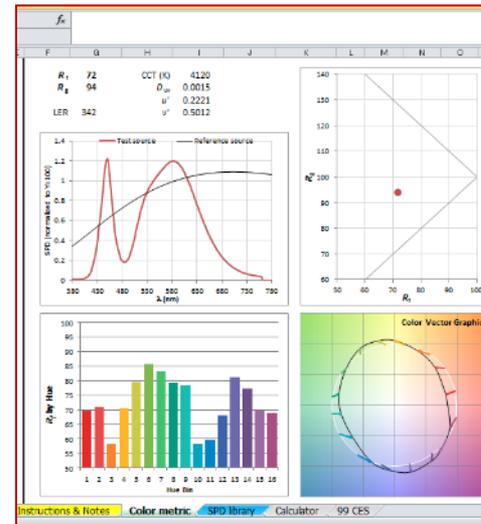


**SMUD**™



# The Old NGL

Hands-on  
Visual  
Deliberative  
Documented



# From NGL to NGLS

2008: Focus on LED luminaires of different types

2012: Split into separate Indoor and Outdoor Competitions

2015: Focus on controllability and serviceability

2016: Focus on specific applications and connected systems

From Next Generation *Luminaires*  
to Next Generation *Lighting Systems*.

2017: *Exclusively* Indoor Connected Lighting Systems

- Build on 2016 experience
- Separate into levels of system complexity
- Permanent installations
- Ongoing evaluations



# NGLS Indoor Competitions

2017

2019

## COMPETITION 1

Easily installed and configured systems

IN PROGRESS

## COMPETITION 2

Easily installed and configured LED troffer conversion (retrofit) kits with luminaire integrated sensors and controls

## COMPETITION 3

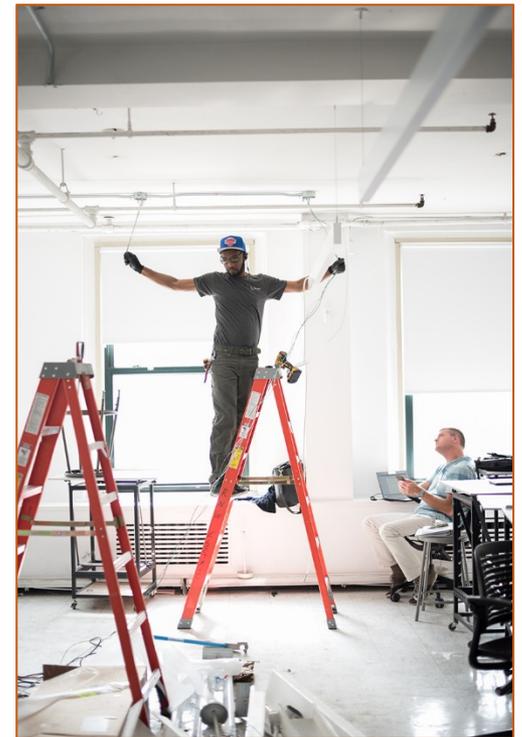
More capable and complex systems that are commissioned onsite

## COMPETITION 4

More capable and complex systems that are commissioned onsite and feature color-tuning luminaires

# Defining 'Easy'

- What makes a system easy to install?
  - What makes a system easy to configure?
  - Will it also be easy to re-configure?
- 
- Who Decides?
    - Specifier
    - Facilities Staff
    - Installation Contractor
    - Manufacturer



# Design and Installation Process

Model the process to learn and share

Identify challenges faced in design, installation, and configuration.

Identify documentation and communication challenges.

NGLS/Specifier

- Performance specifications
- Lighting layout

Manufacturer(s)

- Submits proposed system

NGLS/Specifier

- Review/approve

Contractor

- Install and configure system

Provide feedback to manufacturers to influence product innovation – what worked, what didn't?

Identify key elements to include in a specification.

# Competition 1 & 2 Focus

Luminaire and control systems that are:

- Marketed as “easy” to install and configure
- Intended for contractor setup and configuration without prior training
- Configurable without manufacturer assistance
- No lighting designer involved



# Location



# Basic System Requirements

	COMPETITION			
	1	2	3	4
Luminaire	NEW	RETROFIT KIT	NEW	NEW
Tunable Color	NO	NO	NO	YES
Luminaire-Integrated Sensor and control	PREFERRED	YES	OPTIONAL	OPTIONAL
Easy-Configuration (NO MFR assistance)	YES	YES	OPTIONAL	OPTIONAL

# Participating Manufacturers

## Competition One

Company	Control System	Luminaire / Retrofit Kit
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

## Competition Two

Company	Control System	Luminaire / 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
Cree	SmartCast	ZR-RK Retrofit Troffer
Hubbell Lighting	NX Distributed Intelligence	Columbia SLK LED Troffer Conversion Kit
LG Electronics	Sensor Connect	Simple Choice Retrofit Kit

# Lighting Performance Requirements

Task Plane Illumination	Illuminance Uniformity	Maximum Luminaire Luminous Intensity	Maximum Luminance Ratio	
Average initial at full power	Average to minimum across work plane	Degrees above nadir	Between task and immediate background surfaces	Between task and distant background surfaces (ceiling, walls, floor)
45 – 55 fc	2:01	300 cd @ 65° 185 cd @ 75° 60 cd @ 85°	3:01	10:1 or 1:10

# Control Performance Requirements

1. Grouped into **two** zones as indicated on the room layout drawing. **Manual dimming** to 10% for each zone.
2. Occupancy control – for each of two zones, turns OFF, time out period of **20 minutes**. Vacancy operation **auto off**, **manual on**.
3. Daylight harvesting – light level in daylight zone changes in response to daylight
4. High end trim/Task tuning – required capability, no specific setting specified
5. Control settings shall be adjustable by the user **without factory assistance**.

# Installation Evaluation Process

- Three evaluation phases
  - Install luminaires
  - Install and start up controls
  - Adjust control settings
- After each phase, contractor and NGLS judges independently evaluate:
  - Manufacturer's documents
  - Ease/difficulty
  - Strengths and weaknesses
- Conclude with videotaped contractor interviews



# Manufacturer Participation



# Performance Evaluation Process

- Lighting Performance
  - Lighting effects, luminaire construction and appearance
  - Measured performance (illuminance, CCT, luminance, etc.)
- Control System Performance
  - Ease of use
  - Measured performance



# Initial Lessons Learned

- The Process
  - Communication
    - Specifier – Manufacturer
    - Manufacturer - Installer
- The Installation
  - Manufacturer approach to the ‘easy to install’ market
  - Installer preconceptions
- The Configuration
  - User interfaces (wall controls and configuration tools)
  - Conflicting control strategies

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

*George Bernard Shaw*

# Vocabulary

We all speak a different language

- Designers
- Product & IT Engineers
- Contractors



# Different Approaches to the Problem

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

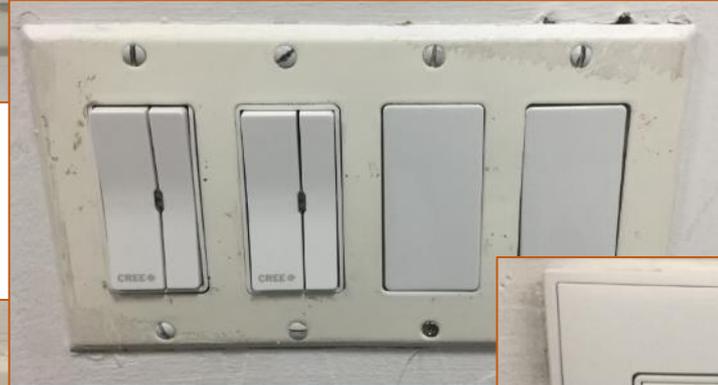
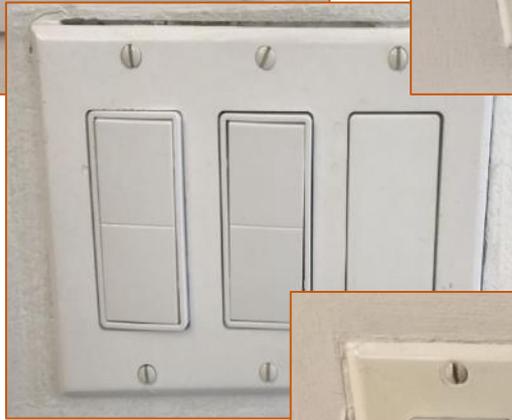
# Configuration Tools



# Number and Types of Components



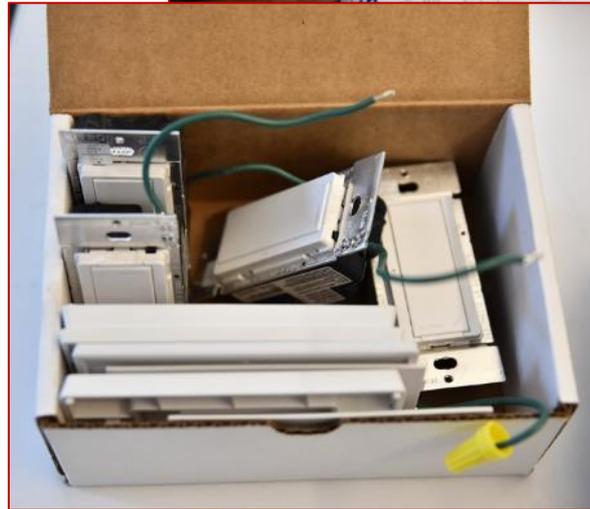
# Wall Controls – 7 Approaches



# Installer Preconceptions



# On the Drawing or In the Box



# Control Strategy Integration

- Which strategy takes precedence?
- What about manual over-rides?
- How do specifiers describe what they want?



# Specification Language

- How do specifiers communicate what they intend?
- Can industry collaborate on common language through specification templates or model specs?



# How Can NGLS Help?

- Facilitate industry collaboration
  - Vocabulary
  - Specification language
- Continue specifier/manufacturer communication
- Communicate what we learn as we go

*How will you get involved?*

# NGLS 2018 Activities

- On going User Evaluations (next 2 years)
  - Facilities staff
  - Professors and students
- Competition Two - Installations in January 2018

*Easily Installed and Configured LED Troffer Conversion (Retrofit) Kits with Luminaire Integrated Sensors and Controls*

- Outdoor Competition Opens – Parking Lot Connected Systems, VTTI

# How to Get Involved

- Enter Future Competitions
- Share your connected lighting stories
- Join NGLS working groups to be part of the solution, more information to come
- Contact us at [ngl@pnnl.gov](mailto:ngl@pnnl.gov)

Thanks!  
Questions?