DESIGNLIGHTS CONSORTIUM

2016

STAKEHOLDER MEETING

DLC Networked Lighting Controls

aka DLC “CALC” Project

Member Utilities:

DESIGNLIGHTS CONSORTIUM

- **1998:** knowhow series
- **2006:** HPT8 Project
- **2009:** LED QPL
- **2016:** Advanced Lighting Controls

Commercial Advanced Lighting Controls Project

Demonstration Projects in Partnership with US DOE

Performance Spec and Qualified Products List

Training Programs for Designers and Installers

Advanced Control Savings Calculator

Support for Industry Standards

New Nationally Adopted EE Program Offerings

Commercial Advanced Lighting Controls Project

Goal

Full Scale Adoption of Advanced Lighting Control Technologies

Objectives

Create tools and resources to:

- **Reduce or eliminate market barriers**
- **Equip EE Programs with tools to scale up**
- **Enable at scale partnerships between industry and EE programs**

Aligned Objectives

Energy Efficiency Program Industry

Lighting Controls Industry

Increase Sales and Adoption of Advanced Lighting Controls

Utility Experience with Controls

Poor persistence, unreliable energy savings

- Not designed, installed, commissioned properly
- Building Operators don't know how to use
- Difficult to make changes, reconfigure
- Frequently disabled after the fact

Utilities discount energy savings controls can provide

- Report ~5 yrs of savings for controls vs. ~10 yrs for fixtures
- Apply a discount factor (aka realization rate) to discount calculated control savings

- Unhappy customers
- Cost effectiveness challenges
- Lower Rebates
- Less Promotion

It's not just the utilities…

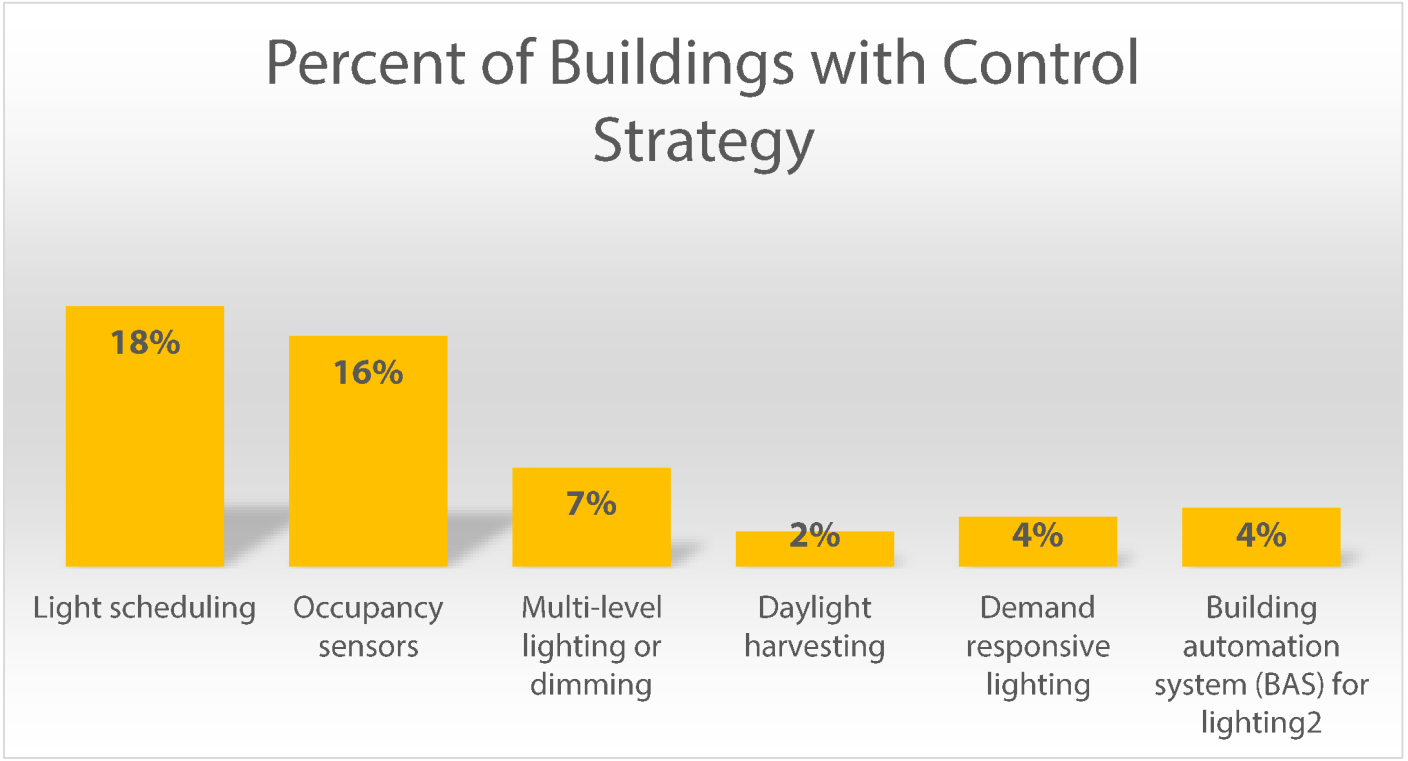
Designers

Contractors

Facility Managers

Building Occupants

Lighting Controls – A Lost Opportunity



Source: 2012 Commercial Buildings Energy Consumption Survey, US Energy Information Administration

Lighting Controls – A Lost Opportunity

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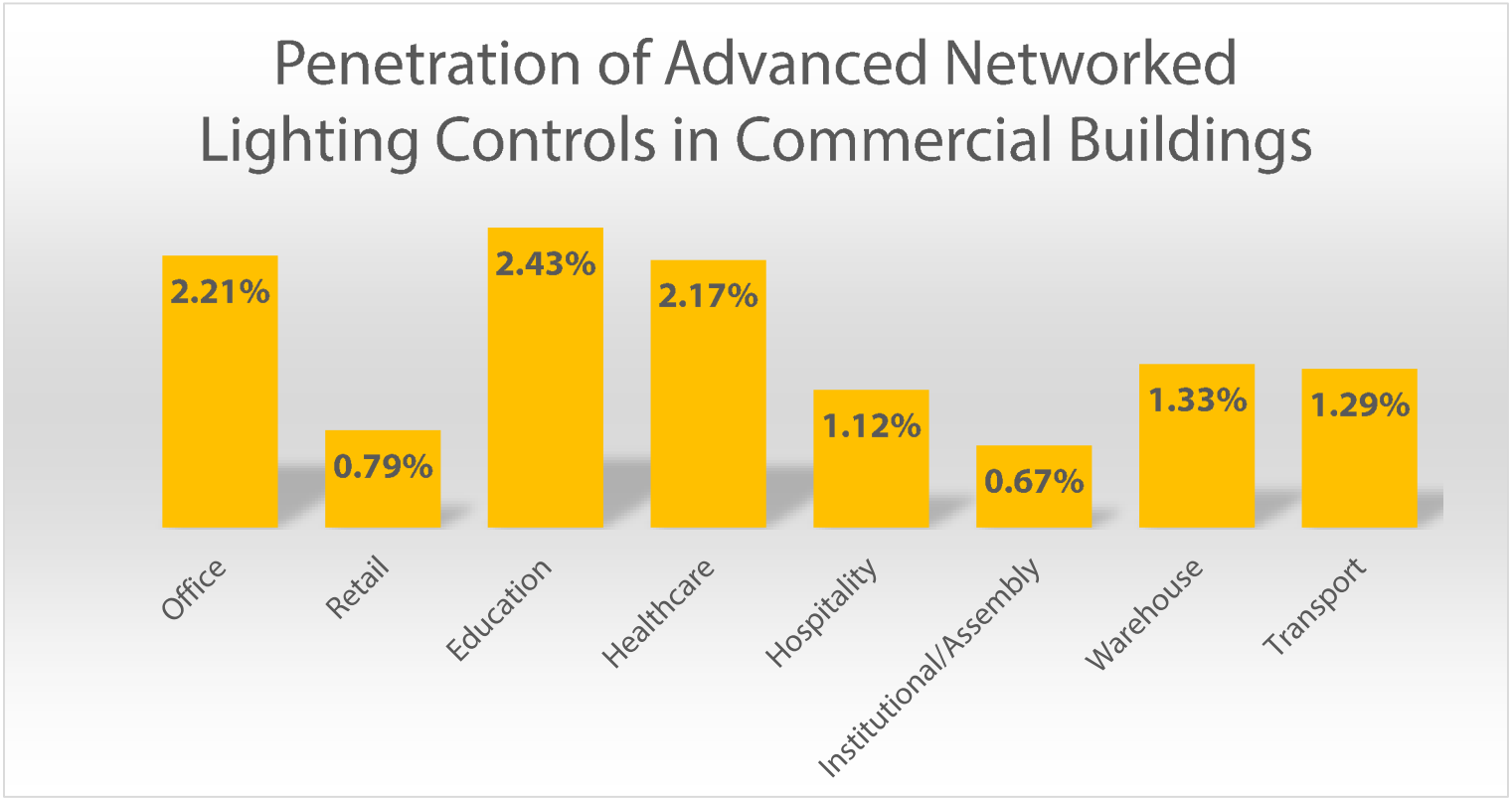
Northwest Region Indoor Lighting Power by Control Type and Building Type

Control Type	All (n=791)	Assembly (n=104)	Food Service (n=43)	Grocery (n=69)	Lodging (n=69)	Office (n=113)	Residential Care (n=68)	Retail (n=129)	School (n=72)	Warehouse (n=43)	Other (n=81)
Manual	2,087 73% ± 2%	279 77% ± 6%	53 87% ± 7%	63 72% ± 8%	121 86% ± 3%	448 68% ± 6%	118 91% ± 3%	447 68% ± 7%	139 61% ± 8%	211 83% ± 7%	208 76% ± 6%
Occupancy Sensor	224 8% ± 1%	27 7% ± 4%	0 0% ± 0%	1 1% ± 1%	1 1% ± 1%	73 11% ± 4%	3 2% ± 2%	12 2% ± 1%	34 15% ± 5%	43 17% ± 7%	32 12% ± 4%
EMS System	256 9% ± 2%	33 9% ± 4%	2 3% ± 4%	6 7% ± 5%	0 0% ± 1%	45 7% ± 4%	1 1% ± 1%	120 18% ± 5%	30 13% ± 6%	0 0% ± 0%	18 7% ± 4%
Dimming	24 1% ± 0%	10 3% ± 2%	4 7% ± 5%	0 0% ± 0%	4 3% ± 1%	1 0% ± 0%	1 0% ± 1%	0 0% ± 0%	1 0% ± 0%	1 0% ± 1%	2 1% ± 1%
Timeclock	74 3% ± 1%	7 2% ± 2%	0 0% ± 0%	2 2% ± 3%	2 1% ± 1%	31 5% ± 3%	1 0% ± 0%	28 4% ± 3%	2 1% ± 1%	0 0% ± 1%	2 1% ± 1%
Photocell	13 0% ± 0%	0 0% ± 0%	0 0% ± 1%	0 0% ± 0%	1 0% ± 0%	4 1% ± 1%	0 0% ± 0%	8 1% ± 1%	0 0% ± 0%	0 0% ± 0%	0 0% ± 0%
Other	126 4% ± 1%	5 1% ± 1%	0 0% ± 0%	5 6% ± 3%	0 0% ± 0%	50 8% ± 4%	0 0% ± 0%	33 5% ± 3%	24 10% ± 5%	0 0% ± 0%	9 3% ± 2%
None (Continuous)	54 2% ± 0%	3 1% ± 0%	1 2% ± 4%	11 12% ± 6%	13 9% ± 3%	6 1% ± 0%	6 5% ± 2%	10 2% ± 1%	0 0% ± 0%	0 0% ± 0%	4 2% ± 1%

Lighting Controls – A Lost Opportunity



Source: DLC, Navigant Consulting 2014

Lighting Controls – A Lost Opportunity

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Utilization of Advanced Networked Controls within EE Programs less than 1%

Energy Efficiency Program	Number of Projects with Advanced Networked Controls	Total Number of Lighting Projects	Utilization Rate
Efficiency Vermont (2011-2013)	<10	1,885	<0.5%
Cape Light Compact (2013)	0	291	0%
Burlington Electric Department (2013)	0	153	0%
PSEG Long Island (2013)	<25	5602	<0.5%

Adoption Barriers

- Knowledge and Experience
- Complexity
- Lack of Standardization
- High Costs
- Value Proposition
- EE Program Designs

Commercial Advanced Lighting Controls Project

Demonstration Projects in Partnership with US DOE

Performance Spec and Qualified Products List

Training Programs for Designers and Installers

Advanced Control Savings Calculator

Support for Industry Standards

New Nationally Adopted EE Program Offerings

Our Vision

By 2020…

- Every luminaire seen by EE programs is controlled
- Advanced systems required for the vast majority of projects to receive any rebates/incentives
- Systems/Controls deliver reliable, long-term savings and occupant/owner satisfaction
- Technology, installation cost and complexity greatly reduced
- Market actors, users knowledgeable and skilled on how to use Advanced Systems/Controls

Demonstration Projects

Demonstration Projects in Partnership with US DOE

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Demonstration Projects

U.S. DEPARTMENT OF ENERGY

- Enlighted
- Daintree ControlScope
- Philips Connected PoE
- Digital Lumens
- Cree SmartCast
- Philips SpaceWise
- Lutron Vive Energi Tri-pak
- OSRAM Encelium
- Eaton DLVP

- Selected Technologies by RFQ
- Scoring Criteria heavily weighted to products that used innovative approaches to overcome technology adoption barriers

Features that were scored highly

- “Embedded” or “Integrated” Sensors
- Wireless
- Open-standards based or as interoperable as possible
- Distributed Intelligence
- Embedded energy meter
- Auto-Commissioning
- Well-executed programing interface or GUI

First Five Projects

Two Roads Brewing Company – Stratford, CT

- Install Complete
- Status: Analyzing Metering Results

Rhode Island Public Utilities – Warwick, RI

- Install Complete
- Status: Post-Metering

Multi-Tenant Medical Office Building – Avon, CT

- Install Complete
- Status: Post Metering

University of Vermont PFG Sports Complex – Burlington, VT

- Status: Finalizing Scope/Budget
- Install over Summer

Super Stop & Shop – New Bedford, MA

- Status: Scope Budget Complete, Developing M&V Plan
- Install begins July 8

Two Roads Brewing Company

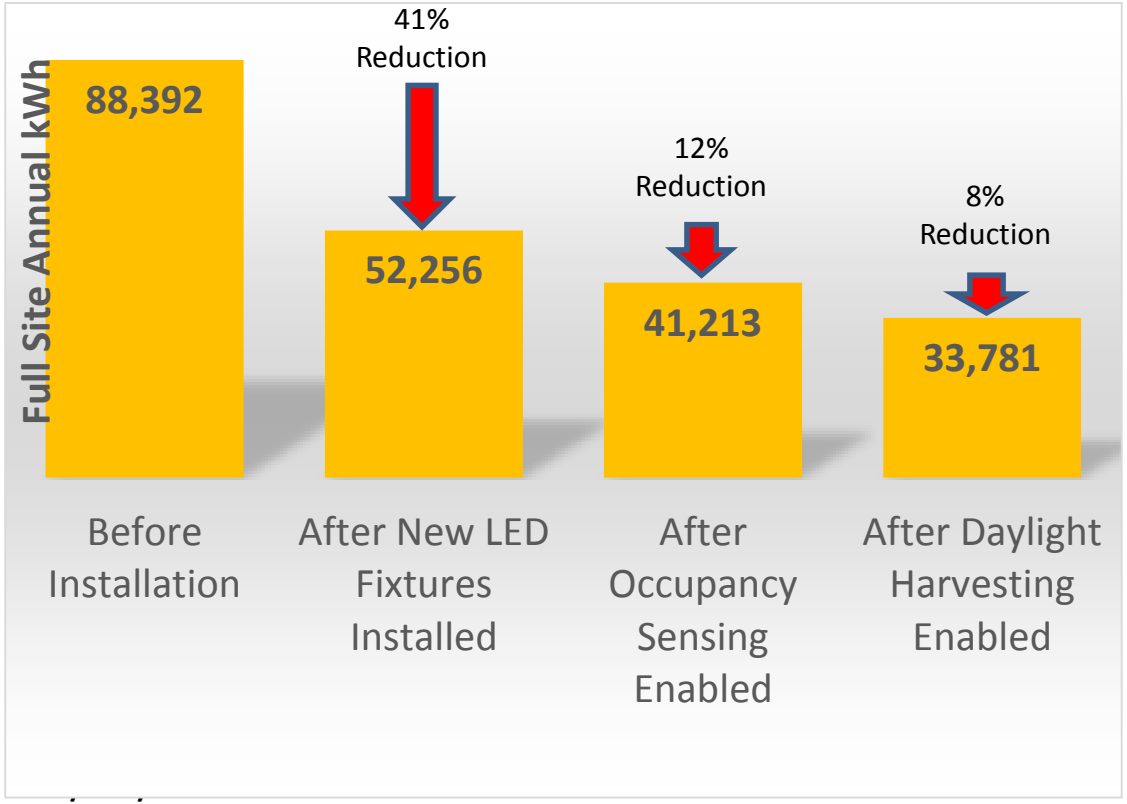
Technology: Digital Lumens Intelligent Lighting System

Low-Bay Areas

Office Areas
(Integrated into Philips Evokit Troffer)

High-Bay Areas

Preliminary Results – Digital Lumens at Two Roads Brewing



62% Energy Savings

7 yr Payback before utility incentives

3.5 yr Payback after utility incentives

Demonstration Projects – Next Five

- Philips Connected POE
- Lutron Vive Energi Tri-pak
- OSRAM Encelium
- Eaton DLVP
- TBD

- Site Recruitment Underway

Specification and QPL

Demonstration Projects in Partnership with US DOE

Performance Spec and Qualified Products List

Training Programs for Designers and Installers

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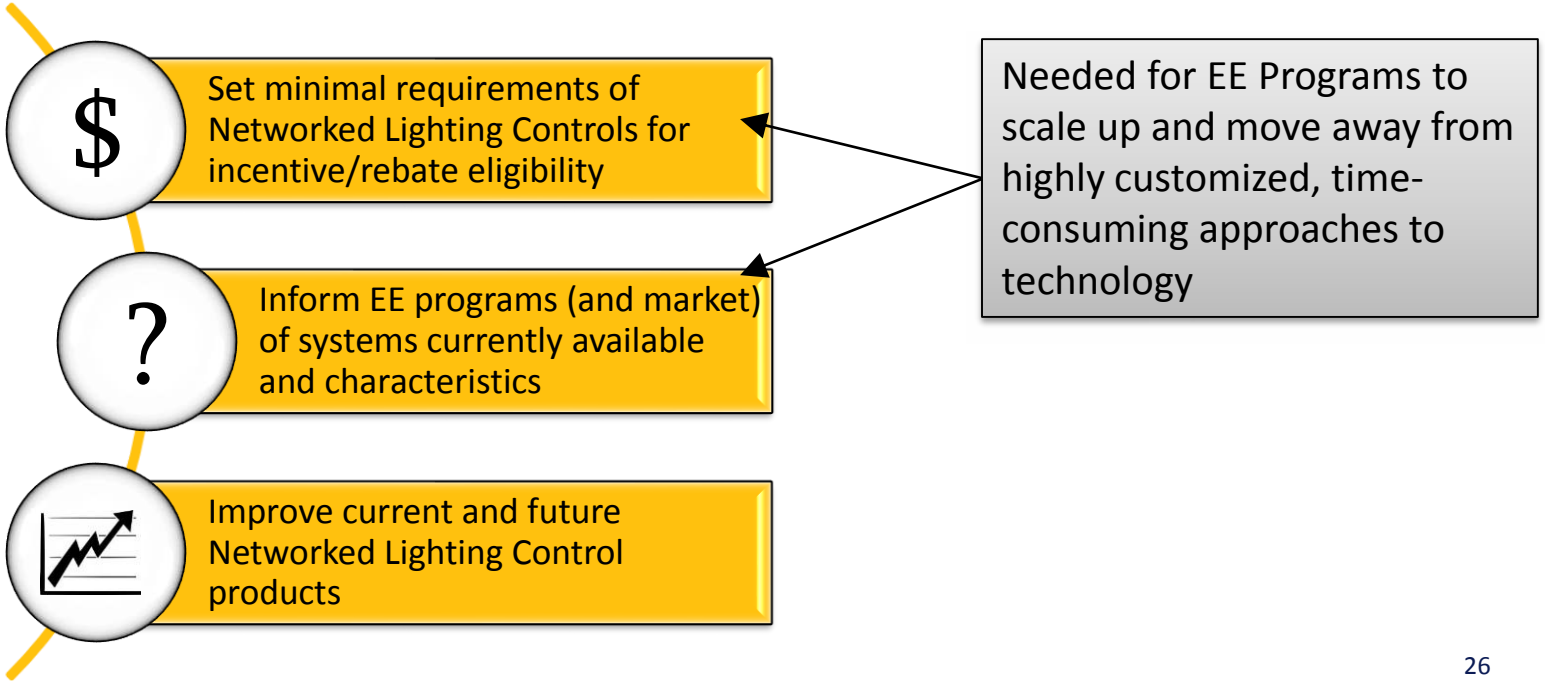
New Nationally Adopted EE Program Offerings

Why a Specification and QPL for Networked Controls?

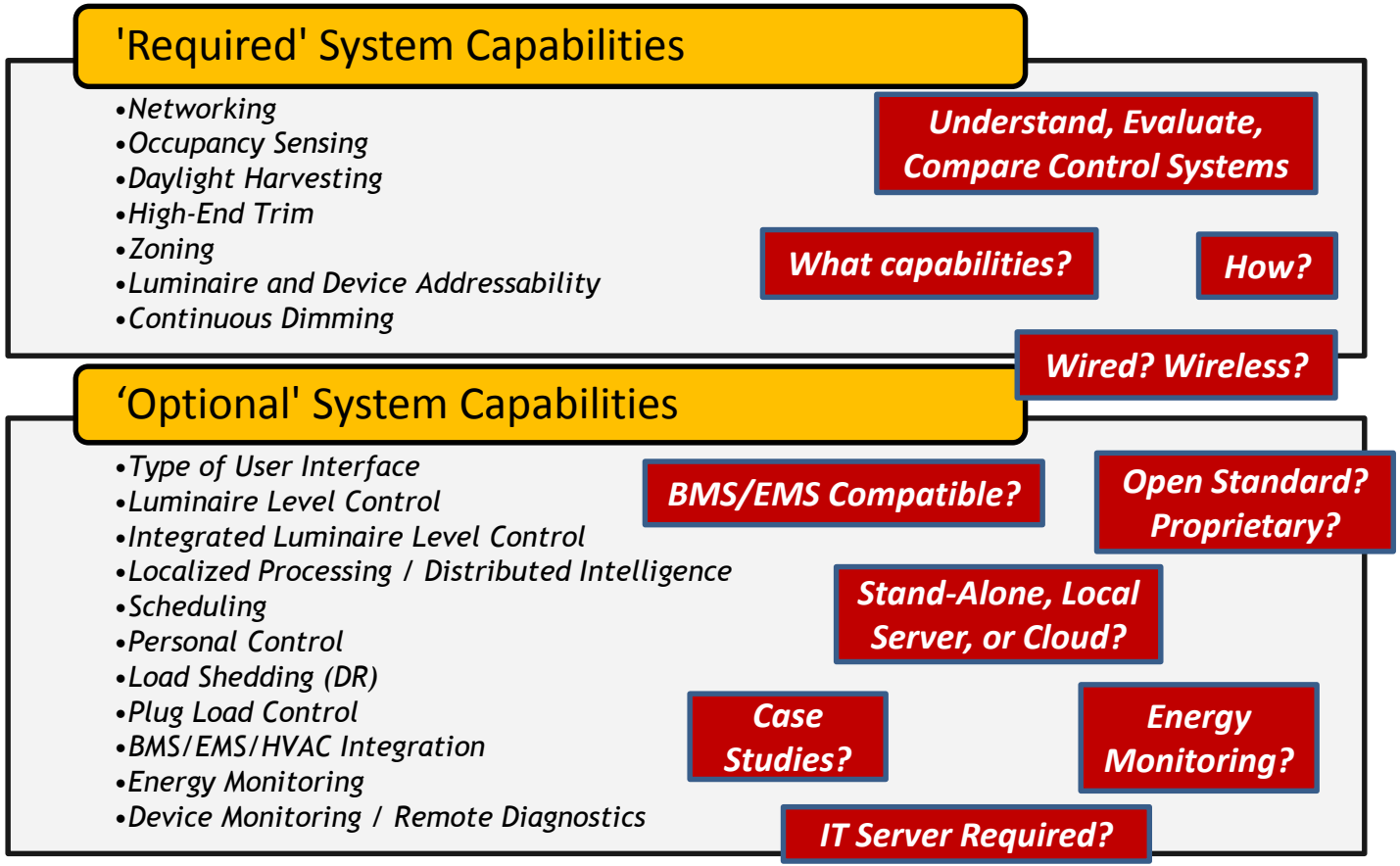
DLC aims to work in partnership with Member Energy Efficiency Programs to:

- Drive significant new energy savings from Networked Lighting Control Systems
- Support market expansion
- Create a single point of entry and efficient process for manufacturers to participate in this market

Purpose of Specifications and Qualified Products List



QPL: A New Tool to Understand and Evaluate Control Systems



QPL will be key component of other CALC Project Activities

- Training Programs will use QPL to educate on types of systems available
- Program Offerings will use QPL to determine what is eligible for incentives

Scope of Specification

- Spec is for Networked Lighting Control Systems
- Defined as combination of sensors, network interfaces, and controllers that affect changes to luminaires
- Does not include requirements for luminaires
- Control requirements for luminaires addressed separately by the DLC's Solid-State Lighting Specification and Qualified Products List

Interior Controls, Not Exterior

- Specification is for Interior Networked Controls only
- Exterior specification may be developed in future

Structure of Spec: "Required" and "Reported" Capabilities

"Required"

Capabilities that systems must have to be listed on the QPL. QPL will identify presence of, type, and/or characteristics on QPL.

"Reported"

Capabilities that are not required, but QPL will identify presence of, type, and/or characteristics on QPL.

Required vs. Reported Capabilities

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'Required' System Capabilities

- *Networking of Luminaires and Devices*
- *Occupancy Sensing*
- *Daylight Harvesting*
- *High-End Trim*
- *Zoning*
- *Luminaire and Device Addressability*
- *Continuous Dimming*

'Reported' System Capabilities

- *Type of User Interface*
- *Luminaire Level Control*
- *Integrated Luminaire Level Control*
- *Localized Processing / Distributed Intelligence*
- *Scheduling*
- *Personal Control*
- *Load Shedding (DR)*
- *Plug Load Control*
- *Other Building Systems Integration*
- *Energy Monitoring*
- *Device Monitoring / Remote Diagnostics*

QPL Demonstration

Training Programs

Demonstration Projects in Partnership with US DOE

Performance Spec and Qualified Products List

Training Programs for Designers and Installers

Advanced Control Savings Calculator

Support for Industry Standards

New Nationally Adopted EE Program Offerings

Two Curriculums

Designers + Specifiers

Contractors + Installers

Curriculum Focus Areas

- Types of systems and capabilities, especially new systems that reduce complexity and cost
- Choosing the right system for the application
- Techniques to reduce cost
- How to design, specify, install for success

Framework – Installer Training

- ½ to Full Day Training
- Part 1: Utilities deliver generic content to all attendees on systems and rebates (2-3 hours)
- Part 2: Manufacturers deliver specific content on their specific system to sub-groups of attendees in round-robin format (2-3 hours total)

Framework – Designer Training

- 2-3 hour Training or Webinar Format
- Generic content of installer training plus design and specification techniques to improve communication and reduce cost

Contractor / Installer Training

- Draft Curriculum August 30
- Pilot with select DLC Members and Manufacturers Q4
- Implementation 2017

Specifier / Designer Training

- Draft Curriculum October 30
- Pilot Q4
- Implementation 2017

Savings Calculator

Demonstration Projects in Partnership with US DOE

Performance Spec and Qualified Products List

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Support for Industry Standards

New Nationally Adopted EE Program Offerings

ALCS Energy Estimator

PG&E

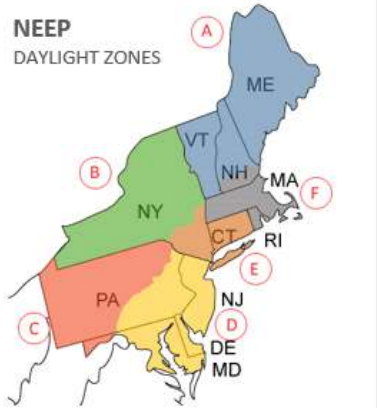
BETA Version 1.0b4 (NEEP) - DO NOT DISTRIBUTE

Existing Conditions

INPUTS (SCREENING PHASE)

Project Information

Project Identifier (Name)		ABC Inc. Office Building
Street Address		123 A Street, Lexington, MA 02421
Utility		National Grid
Daylight Zone (Refer to map)	*	Zone C
Contact Name, Phone		John Doe, (555) 555-5555
Contact email		johndoe@gmail.com
Project ID.		NEEP0011022
Project Type	*	Existing Building Alteration
Building Category	*	Office - Small
Approximate Year Built	*	2004 - 2006
Code Baseline	*	ASHRAE 90.1-2013



Instructions | 1 Existing Inputs | 2 Proposed Inputs | 3 Detailed Inputs | 4 Calculated Savings | 5 Dashboard

ALCS Energy Estimator

- Objective: Develop a consistent and accurate methodology and tool for estimating savings of Advanced Lighting Control Systems
- Target Audience: Utilities to start, eventually the wider market
- Key Functionality: Estimate savings compared to existing conditions and various energy code baselines

Status

- Beta version developed and initial Beta testing complete.
- Accuracy Testing underway
- Deployment to DLC Member utilities in 2017
- Deployment to wider market in future

New Program Offerings

Demonstration Projects in Partnership with US DOE

Performance Spec and Qualified Products List

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New Nationally Adopted EE Program Offerings

Unified National Incentive Strategies – 2 Complimentary Methods

Easy to use, prescriptive

- System-based for simple or integrated systems
  - DLC per Luminaire rebate PLUS
  - **Additional** per luminaire rebate if controlled by Qualified Networked Control System

High Volume

Custom w Predictable Rebate

- For more complex systems, projects
- Predictable $/ft^2 rebate
- Custom Savings Calculation using new tool
- Bonus $ for energy monitoring
- Pay for Performance?

Low Volume

DLC Members that will require Systems to be on NLC QPL in 2016 or 2017*

FORTIS BC powersense
Hydro Québec
Hawaii Energy
DUKE ENERGY
Seattle City Light
SaskPower Powering the future
your NEW HAMPSHIRE Electric Co-op
Pacific Gas and Electric Company
DTE Energy
SMUD
efficiency NOVA SCOTIA
focus on energy Partnering with Wisconsin utilities
efficiency MAINE
EVERSOURCE
EFFICIENCY$MART
nationalgrid HERE WITH YOU. HERE FOR YOU.
Xcel Energy RESPONSIBLE BY NATURE
PNM

*Based on Survey Responses from 55% of DLC Members

DLC Members launching specialized programs/rebates for NLCs

Pacific Gas and Electric Company

Seattle City Light

Consumers Energy

EVERSOURCE

nationalgrid
HERE WITH YOU. HERE FOR YOU.

efficiency NOVA SCOTIA

DTE Energy

focus on energy
Partnering with Wisconsin utilities

*Based on Survey Responses from 55% of DLC Members

DLC Members actively *considering* specialized programs/rebates for NLCs

FORTIS BC powersense
Hydro Québec
SaskPower Powering the future
Hawaii Energy
Seattle City Light
efficiency NOVA SCOTIA
SMUD
your NEW HAMPSHIRE Electric Co-op
EFFICIENCY$MART
efficiency MAINE
Xcel Energy RESPONSIBLE BY NATURE
PNM

*Based on Survey Responses from 55% of DLC Members

Thank You!

- Manufacturers: please submit your qualified systems as soon as possible. Any questions, email info@designlights.org

Appendix

Required: Networking of Luminaires and Devices

Capability	Definition
Networking of Luminaires and Devices	The capability of individual luminaires and control devices to exchange digital data with other luminaires and control devices on the system. This capability is required at the room or space level, but not at the whole building level or beyond (e.g. non-lighting systems, or the internet).
You will also need to report: • Size limitations of network • Wired, Wireless, or Both? • Compliance with any standards, protocols, or specifications	

Required: Occupancy Sensing

Capability	Definition
Occupancy Sensing	The capability to affect the operation of lighting or other equipment based upon detecting the presence or absence of people in a space.

You will also need to report:

- Whether system has vacancy mode
- Modes of detection
- Coverage Options
- What settings can be adjusted
- Default settings
- Whether system can set to a dim level when unoccupied
- Whether self-commissioning or self-optimizing and how

Required: Daylight Harvesting

Capability	Definition
Daylight Harvesting	The capability to automatically affect the operation of lighting or other equipment based on the amount of daylight and/or ambient light that is present in a space.

You will also need to report:

- Open-loop, closed-loop, or both
- Whether system can turn light source fully off and how
- Integration with shading systems and how
- What settings can be adjusted
- Whether self-commissioning or self-optimizing and how

Required: High-End Trim

Capability	Definition
High-End Trim	The capability to set the maximum light output of an individual or group of luminaires at the time of installation or commissioning. High-End Trim must be field reconfigurable.
You will also need to report: • What settings and range of settings • Default settings • Whether settings can be reported	

Required: Zoning

Capability	Definition
Zoning	The capability to group luminaires and form unique lighting control zones for a control strategy. Zoning is required for Occupancy Sensing, High-End Trim, and Daylight Harvesting control strategies except for systems that feature Luminaire Level Control (LLC) capabilities as defined in this specification under “Reported Capabilities”, in which case zoning is only required for Occupancy Sensing and High-End Trim control strategies.
You will also need to report: • The methodology or process for grouping luminaires to form zones	

Required: Luminaire and Device Addressability

Capability	Definition
Luminaire and Device Addressability	The capability to uniquely identify and/or address each individual luminaire, sensor, controller, and user interface device in the lighting system, allowing for configuration and re-configuration of devices and control zones independent of electrical circuiting. Please note that while DLC requires systems to have this addressability capability, systems that also offer traditional electrically circuited control zones as an option (e.g. zones defined by 0-10V wiring) will not be disqualified.
You will also need to report: • N/A	

Required: Continuous Dimming

Capability	Definition
Continuous Dimming	The capability of a control system to provide control with sufficient resolution (100+ steps) to support light level changes perceived as smooth (as opposed to step dimming with a few discrete light levels).

You will also need to report:

- Types of continuous dimming (0-10V, Forward Phase, Reverse Phase, DALI, Proprietary, etc.)
- Dimming curve(s) used by system (linear, square, proprietary)
- Any dimming standards product complies with.

Reported: Type of User Interface

Capability	Definition
Type of User Interface	The type of interface used by the control system for reading and adjusting control system settings during system start-up, commissioning, and/or ongoing operation.

You will need to report:

- Type of interface for 1) Startup/Commissioning and 2) Ongoing System Configuration
- Interface platform
- Whether interface provides 2-way communication
- If GUI, whether floorplan can be uploaded and how
- What settings can be changed, reported, displayed

Reported: Luminaire Level Control (LLC, non-integrated)

Capability	Definition
Luminaire Level Control (LLC, non-integrated)	The capability to have an occupancy sensor, ambient light sensor and luminaire controller installed for each luminaire.
You will need to report: • Whether system is available with this capability • If yes, what control protocols are used	

Reported: Integrated Luminaire Level Control (LLC, Integrated)

Capability	Definition
Luminaire Level Control (LLC, non-integrated)	The capability to have an occupancy sensor and ambient light sensor installed for each luminaire, and directly integrated or embedded into the luminaire form factor during the luminaire manufacturing process.
You will need to report: • Whether system is available with this capability • If yes, what manufacturer(s) and what luminaires are available	

Reported: Localized Processing / Distributed Intelligence

Capability	Definition
Localized Processing / Distributed Intelligence	The capability of sensors and luminaires to execute pre-programmed energy savings strategies in the absence of (resulting from either a loss of network connection or failure) a gateway or central processor.

You will need to report:

- Whether system has this capability
- If yes, what strategies can function without connection to gateway or central processor (manual switching/dimming, personal control, occupancy sensing, etc.)

Reported: Scheduling

Capability	Definition
Scheduling	The ability to affect the operation of lighting or other equipment based on time or day or astronomical event.

You will need to report:

- If system has scheduling capability
- If yes, whether uses astronomical timeclock
- Whether system provides holiday and special schedule programming.
- Whether override switch option
- Factory default schedule
- If scheduling can be layered with other control strategies by timer or priority (i.e. ability to control lighting by schedule during day, occupancy at night)

Reported: Personal Control

Capability	Definition
Personal Control	The capability for individual users to adjust the illuminated environment to their personal preferences within a space.

You will need to report:

- If system has personal control capability
- If yes, what interface it uses (i.e. smartphone app, desktop windows, etc.)
- Can luminaires be grouped for personal control?
- Does system learn/adapt to user's preferences? How?
- Can usage and settings be reported? How?

Reported: Load Shedding (DR)

Capability	Definition
Load Shedding (Demand Response)	The capability to reduce the energy consumption of a lighting system, in a pre-defined way, on a temporary basis, in response to a demand response signal.

You will need to report:

- If system has load shedding capability
- If it can be implemented via an external signal and how
- If system can report real time power reduction
- If DR complies with OpenADR standard or other standards
- If tested and verified for standard compliance

Reported: Plug Load Control

Capability	Definition
Plug Load Control	The capability to control the power delivered to receptacles through scheduling or occupancy sensing.

You will need to report:

- If system has plug load control capability
- How the system implements plug load control
- If system has ability to monitor and report energy use of plug loads and how

Reported: Other Building Systems Integration

Capability	Definition
Other Building Systems Integration (BMS, EMS, HVAC, Lighting, etc.)	The ability to exchange data with other building systems such as Building or Energy Management Systems (BMS/EMS), Heating Ventilation and Air Conditioning (HVAC) Systems, or other Lighting systems. The method by which the system implements this capability must be clearly described in the application.

You will need to report:

- Whether system has this capability
- What BMS/EMS or other systems can system communicate with? How? What components are required?
- What information or data can be communicated?
- Whether certified for compliance with any BMS/EMS standards or industry specifications.
- Whether and what data can be exchanged with HVAC systems

Reported: Energy Monitoring

Capability	Definition
Energy Monitoring	The ability of a system, luminaire, or device to report its own energy consumption, or the energy consumption of any controlled device via direct measurement or other methodology. The method by which the system implements this capability must be clearly described. The accuracy or reported data must be specified, and the method by which accuracy is determined must be clearly described in the application.

You will need to report:

- Whether system has Energy Monitoring capability
- Detailed explanation of methodology
- Meter characteristics
- What is measured
- What data is collected
- Data format
- Any industry standards energy monitoring complies with

Reported: Device Monitoring / Remote Diagnostics

Capability	Definition
Device Monitoring / Remote Diagnostics	The capability of the system to monitor, diagnose, and report its operational performance

You will need to report:

- Whether system has Device Monitoring/Remote Diagnostics Capability
- What specific system characteristics can be monitored, diagnosed, and/or reported? (i.e. component failures, remaining life, latency, etc.)
- What mechanisms are provided to alert system problems or failures. (i.e. email alert, blinking light, etc.)

Reported: Operational and Standby Power

Capability	Definition
Operational and Standby Power	The power use of control system devices in active and standby modes
You will need to report: • Whether you have this information available • If yes, provide it	