• **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

Percent of Buildings with Control Strategy

- Light scheduling: 18%
- Occupancy sensors: 16%
- Multi-level lighting or dimming: 7%
- Daylight harvesting: 2%
- Demand responsive lighting: 4%
- Building automation system (BAS) for lighting: 4%

### Northwest Region Indoor Lighting Power by Control Type and Building Type

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

Penetration of Advanced Networked Lighting Controls in Commercial Buildings

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>2.21%</td>
</tr>
<tr>
<td>Retail</td>
<td>0.79%</td>
</tr>
<tr>
<td>Education</td>
<td>2.43%</td>
</tr>
<tr>
<td>Healthcare</td>
<td>2.17%</td>
</tr>
<tr>
<td>Hospitality</td>
<td>1.12%</td>
</tr>
<tr>
<td>Institutional/Assembly</td>
<td>0.67%</td>
</tr>
<tr>
<td>Warehouse</td>
<td>1.33%</td>
</tr>
<tr>
<td>Transport</td>
<td>1.29%</td>
</tr>
</tbody>
</table>

Source: DLC, Navigant Consulting 2014
Utilization of Advanced Networked Controls within EE Programs less than 1%

<table>
<thead>
<tr>
<th>Energy Efficiency Program</th>
<th>Number of Projects with Advanced Networked Controls</th>
<th>Total Number of Lighting Projects</th>
<th>Utilization Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency Vermont (2011-2013)</td>
<td>&lt;10</td>
<td>1,885</td>
<td>&lt;0.5%</td>
</tr>
<tr>
<td>Cape Light Compact (2013)</td>
<td>0</td>
<td>291</td>
<td>0%</td>
</tr>
<tr>
<td>Burlington Electric Department (2013)</td>
<td>0</td>
<td>153</td>
<td>0%</td>
</tr>
<tr>
<td>PSEG Long Island (2013)</td>
<td>&lt;25</td>
<td>5602</td>
<td>&lt;0.5%</td>
</tr>
</tbody>
</table>
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
- 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
Demonstration Projects

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

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

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Location</th>
<th>Status and Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Roads Brewing Company – Stratford, CT</td>
<td>Stratford, CT</td>
<td>Install Complete, Status: Analyzing Metering Results</td>
</tr>
<tr>
<td>Rhode Island Public Utilities – Warwick, RI</td>
<td>Warwick, RI</td>
<td>Install Complete, Status: Post-Metering</td>
</tr>
<tr>
<td>Multi-Tenant Medical Office Building – Avon, CT</td>
<td>Avon, CT</td>
<td>Install Complete, Status: Post-Metering</td>
</tr>
<tr>
<td>University of Vermont PFG Sports Complex – Burlington, VT</td>
<td>Burlington, VT</td>
<td>Status: Finalizing Scope/Budget, Install over Summer</td>
</tr>
<tr>
<td>Super Stop &amp; Shop – New Bedford, MA</td>
<td>New Bedford, MA</td>
<td>Status: Scope Budget Complete, Developing M&amp;V Plan, Install begins July 8</td>
</tr>
</tbody>
</table>
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

- **Before Installation**: 88,392 kWh
- **After New LED Fixtures Installed**: 52,256 kWh (41% Reduction)
- **After Occupancy Sensing Enabled**: 41,213 kWh (12% Reduction)
- **After Daylight Harvesting Enabled**: 33,781 kWh (8% Reduction)

**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
- Training Programs for Designers and Installers
- Support for Industry Standards
- Performance Spec and Qualified Products List
- Advanced Control Savings Calculator
- 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

- Set minimal requirements of Networked Lighting Controls for incentive/rebate eligibility
- Inform EE programs (and market) of systems currently available and characteristics
- Improve current and future Networked Lighting Control products

Needed for EE Programs to scale up and move away from highly customized, time-consuming approaches to technology
QPL: A New Tool to Understand and Evaluate Control Systems

'Required' System Capabilities
- Networking
- Occupancy Sensing
- Daylight Harvesting
- High-End Trim
- Zoning
- Luminaire and Device Addressability
- Continuous Dimming

Understand, Evaluate, Compare Control Systems

What capabilities?

How?

'Optional' 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
- BMS/EMS/HVAC Integration
- Energy Monitoring
- Device Monitoring / Remote Diagnostics

BMS/EMS Compatible?

Open Standard? Proprietary?

Stand-Alone, Local Server, or Cloud?

Case Studies?

Energy Monitoring?

IT Server Required?
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

'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
- Training Programs for Designers and Installers
- Advanced Control Savings Calculator
- Support for Industry Standards
- New Nationally Adopted EE Program Offerings
ALCS Energy Estimator

<table>
<thead>
<tr>
<th>Existing Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUTS (SCREENING PHASE)</td>
</tr>
</tbody>
</table>

### Project Information
- Project Identifier (Name)
- Street Address
- Utility
- Daylight Zone (Refer to map)
- Contact Name, Phone
- Contact email
- Project ID.
- Project Type
- Building Category
- Approximate Year Built
- Code Baseline

<table>
<thead>
<tr>
<th>ABC Inc. Office Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>123 A Street, Lexington, MA 02421</td>
</tr>
<tr>
<td>National Grid</td>
</tr>
</tbody>
</table>
- Zone C
- John Doe, (555) 555-5555
- johndoe@gmail.com
- NEEP0011022
- Existing Building Alteration
- Office - Small
- 2004 - 2006
- ASHRAE 90.1-2013

### NEEP
DAYLIGHT ZONES
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
- Training Programs for Designers and Installers
- Advanced Control Savings Calculator
- Support for Industry Standards
- 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

Custom w Predictable Rebate
- For more complex systems, projects
- Predictable $/ft² rebate
- Custom Savings Calculation using new tool
- Bonus $ for energy monitoring
- Pay for Performance?
DLC Members that will require Systems to be on NLC QPL in 2016 or 2017*

*Based on Survey Responses from 55% of DLC Members
DLC Members launching specialized programs/rebates for NLCs

*Based on Survey Responses from 55% of DLC Members
DLC Members actively considering specialized programs/rebates for NLCs

*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

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking of Luminaires and Devices</td>
<td>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).</td>
</tr>
</tbody>
</table>

You will also need to report:
- Size limitations of network
- Wired, Wireless, or Both?
- Compliance with any standards, protocols, or specifications
**Required: Occupancy Sensing**

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy Sensing</td>
<td>The capability to affect the operation of lighting or other equipment based upon detecting the presence or absence of people in a space.</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylight Harvesting</td>
<td>The capability to automatically affect the operation of lighting or other</td>
</tr>
<tr>
<td></td>
<td>equipment based on the amount of daylight and/or ambient light that is</td>
</tr>
<tr>
<td></td>
<td>present in a space.</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-End Trim</td>
<td>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.</td>
</tr>
</tbody>
</table>

You will also need to report:
- What settings and range of settings
- Default settings
- Whether settings can be reported
## Required: Zoning

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoning</td>
<td>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.</td>
</tr>
</tbody>
</table>

**You will also need to report:**
- The methodology or process for grouping luminaires to form zones
Required: Luminaire and Device Addressability

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminaire and Device Addressability</td>
<td>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.</td>
</tr>
</tbody>
</table>

You will also need to report:
- N/A
### Required: Continuous Dimming

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Dimming</td>
<td>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).</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of User Interface</td>
<td>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.</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminaire Level Control (LLC, non-integrated)</td>
<td>The capability to have an occupancy sensor, ambient light sensor and luminaire controller installed for each luminaire.</td>
</tr>
</tbody>
</table>

**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)

<table>
<thead>
<tr>
<th>Capability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminaire Level Control (LLC, non-integrated)</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Capability</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Localized Processing / Distributed Intelligence</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Capability</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Scheduling</td>
<td>The ability to affect the operation of lighting or other equipment based on</td>
</tr>
<tr>
<td></td>
<td>time or day or astronomical event.</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Capability</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Personal Control</td>
<td>The capability for individual users to adjust the illuminated environment to their personal preferences within a space.</td>
</tr>
</tbody>
</table>

**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)**

<table>
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<tbody>
<tr>
<td>Load Shedding (Demand Response)</td>
<td>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.</td>
</tr>
</tbody>
</table>

**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

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<tr>
<th>Capability</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Plug Load Control</td>
<td>The capability to control the power delivered to receptacles through</td>
</tr>
<tr>
<td></td>
<td>scheduling or occupancy sensing.</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Other Building Systems Integration (BMS, EMS, HVAC, Lighting, etc.)</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
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<tbody>
<tr>
<td>Energy Monitoring</td>
<td>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.</td>
</tr>
</tbody>
</table>

### 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

<table>
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</thead>
<tbody>
<tr>
<td>Device Monitoring / Remote Diagnostics</td>
<td>The capability of the system to monitor, diagnose, and report its operational performance</td>
</tr>
</tbody>
</table>

**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

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<tbody>
<tr>
<td>Operational and Standby Power</td>
<td>The power use of control system devices in active and standby modes</td>
</tr>
</tbody>
</table>

You will need to report:
- Whether you have this information available
- If yes, provide it