Presenters

Gabe Arnold
*DLC*

Damon Bosetti
*DLC*
Demonstration Projects in Partnership with US DOE

Networked Lighting Control QPL

Training Programs for Designers and Installers

Advanced Control Savings Calculator

Lighting Control Savings Database

New Rebates and Incentive Models
Goal

Full Scale Adoption of Networked 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
Advanced Lighting Controls have not been widely adopted

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 lighting2: 4%

Advanced Lighting Controls have not been widely adopted

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=61)</th>
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<td>208</td>
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<td>73% ± 2%</td>
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<td>87% ± 7%</td>
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<td>86% ± 3%</td>
<td>68% ± 6%</td>
<td>91% ± 3%</td>
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</table>

Source: 2014 Commercial Building Stock Assessment, NEEA, Navigant, 2014
Barriers to Adoption

- Poor past experiences
- Unfamiliar with technology
- Too complex
- Not standardized
- High costs
- Weak value proposition
DLC Lighting Controls Platform

- Demonstration Projects in Partnership with US DOE
- Networked Lighting Control QPL
- Training Programs for Designers and Installers
- Advanced Control Savings Calculator
- Lighting Control Savings Database
- New Rebates and Incentive Models
Why a QPL for Networked Controls?

_DLC aims to work in partnership with the Lighting Industry and Efficiency Programs to:_

• Drive significant new energy savings from networked controls

• Accelerate adoption; support market expansion

• Create a single point of entry and efficient process for manufacturers to participate with efficiency programs

• Reduce market confusion: create a resource to understand and evaluate Networked Control Systems
Purpose of QPL for Efficiency Programs

Set minimal requirements of Networked Lighting Controls for incentive/rebate eligibility

Inform EE programs and customers of systems currently available

Improve current and future Networked Lighting Control products

Needed by EE Programs to scale up support of technology
# QPL Demonstration

## Networked Lighting Control QPL: Qualified Systems by Capability

**Instructions**
- Press [F4] to filter list by company, brand, system name, or capability.
- Hover mouse pointer over column heading for description of capability.

**Legend**
- Positive answers are shaded green.
- Negative answers are shaded red.

<table>
<thead>
<tr>
<th></th>
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</tbody>
</table>

**Title and Instructions** | **Qualified Systems Summary List** | **Qualified Systems by Capability** | **Detailed Capability List** | +

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11
V2.0 Technical Requirements
Structure of Requirements

“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.
**Interior**

**“Required” Interior System Capabilities**
- Networking of Luminaires and Devices
- Occupancy Sensing
- Daylight Harvesting
- High-End Trim
- Zoning
- Luminaire and Device Addressability
- Continuous Dimming

**“Reported” Interior System Capabilities**
- Control Persistence
- Scheduling
- Energy Monitoring
- Device Monitoring / Remove Diagnostics
- Type of User Interface
- Luminaire Level Lighting Control (LLLC, integrated)
- Personal Control
- Load Shedding (DR)
- Plug Load Control
- External System Integration
- Emergency Lighting
- Security
- Color Changing / Tuning
- Start-Up and Configuration Party
## Exterior

### “Required” Exterior System Capabilities

- Networking of Luminaires and Devices
- Occupancy Sensing AND/OR Traffic Sensing
- Photocell Control
- High-End Trim
- Scheduling
- Zoning
- Luminaire and Device Addressability
- Continuous Dimming

### “Reported” Exterior System Capabilities

- Control Persistence
- Energy Monitoring
- Device Monitoring / Remove Diagnostics
- Type of User Interface
- Load Shedding (DR)
- External System Integration
- Emergency Lighting
- Security
- Color Changing / Tuning
- Start-Up and Configuration Party
Networked Controls Revision Cycle

- Technical Requirements Revised Annually every June 1
- Revision process begins every February to allow time for stakeholder input
- *One Year* Grace Period
DLC Lighting Controls Platform

Demonstration Projects in Partnership with US DOE

Networked Lighting Control QPL

Training Programs for Designers and Installers

Advanced Control Savings Calculator

Lighting Control Savings Database

New Rebates and Incentive Models
Control Adoption Lags

• Simple, manual switches in the US Northwest control 75% of all lighting

• Legacy lighting controls work well, but have “high-maintenance” reputations

• Manufacturers have listened, and new products are solving these problems
Trades Are “The Last Mile”

• Product delivery network needs to be ready for ALCS

• Old experiences and assumptions make ALCS “seem” more expensive in quotes

• Show, don’t tell, our trade allies exactly how the products have changed
Training Makes A Difference

• DOE, NEEA, and Idaho Power sponsored DLC’s pilot ALCS trade ally training

• Blended approach of
  – Academic presentation
  – Design review
  – Hands-on commissioning

• High-impact results, with excellent student feedback

“I learned a huge amount about the growth and birth of developing technologies directly related to my industry and my future. These ideas and practices will definitely be used in residential and commercial aspects of my job.”
Deliver At Scale

• DLC is scoping how to delivery this training at scale, economically

• While we build the portal, we will fine-tune the course with in-person sessions for interested DLC Members

• There may be a role for manufacturers to play: sending hardware and instructors to hands-on wiring and configuration sessions
DLC Lighting Controls Platform

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Demonstration Projects

- Technologies selected by RFQ process in 2015
- 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
- Simple Commissioning
- Well-executed programming interface or GUI
### Five Projects Selected to Move Forward

<table>
<thead>
<tr>
<th>Project</th>
<th>Location</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Roads Brewing Company – Stratford, CT</td>
<td>Stratford, CT</td>
<td>Case study published</td>
</tr>
<tr>
<td>Rhode Island Public Utilities – Warwick, RI</td>
<td>Warwick, RI</td>
<td>Case study under development</td>
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<td>Multi-Tenant Medical Office Building – Avon, CT</td>
<td>Avon, CT</td>
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<td>Yale University – New Haven, CT</td>
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<td>Install Complete – Post Metering</td>
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<tr>
<td>Super Stop &amp; Shop – New Bedford, MA</td>
<td>New Bedford, MA</td>
<td>Case study under development</td>
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</table>
DLC Advanced Lighting Technology Demonstration: Digital Lumens

This demonstration is one in a series of advanced lighting demonstration projects being completed through a joint initiative between the DesignLights™ Consortium (DLC) and the U.S. Department of Energy.

Demonstration Site
Two Roads Brewing Company, founded in 2012, is a brewery offering new twists on a variety of craft beers from their Stratford, Connecticut location in a renovated 1911, 103,000 ft² building. The 2012 renovation changed the building into an industrial-scale microbrewery with bottling operations, a tasting room, offices, restrooms, shipping / receiving, and storage. Although the 2012 renovation installed efficient fluorescent technology, the evolution in LED lighting technology.

The software allows operations staff to manage energy use, optimize lighting to the application thereby supporting employee safety and comfort. Furthermore, the system has automatic measurement and reporting of energy use along with a suite of additional features for optimizing operations.

The Cadmus company measured the lighting system energy use before and after the upgrade to capture the energy usage with and without lighting controls. Replacement of older fluorescents with LEDs alone saved 50.0% of the estimated annual lighting energy use. With occupancy sensing controls, energy savings reached 55.0%.

Two Roads Brewing Company located in Stratford, Connecticut modernized their lighting to capture energy savings and convenience. Photo courtesy of Two Roads Brewing.

Digital Lumens LED Luminaire with integrated sensor and electronic ballast system.
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ALCS Calculator Reduces Uncertainty

• What kind of energy savings will an ALCS give me in this specific situation?
  – Quick-mode: apply DEER default assumptions based on space type and building area, and year of construction
  – Project-specific-mode: for up to 100 rooms, use detailed survey data for high-resolution calculations
  – Calculate versus as-built, and versus current code
  – Assign savings per control measure to weigh cost-benefit
## Quick Screening Calculator

### Lighting Energy Savings Results

#### EXISTING Baseline
(Before - 1999 vintage building)

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<th>Space Types</th>
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<th>Total (kWh/yr)</th>
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<td>5,737.1</td>
<td><strong>14,991.9</strong></td>
<td>3.3</td>
<td>2.1</td>
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#### CODE Baseline
(ASHRAE 90.1-2013)

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<th>Add. Ctrl. (kW/yr)</th>
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<td>4,702.4</td>
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<td>Lobby (Office Reception/Waiting)</td>
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<td>Mechanical/Electrical Room</td>
<td>-29.8</td>
<td>128.5</td>
<td>98.7</td>
<td>-0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>1,021.5</td>
<td>5,737.1</td>
<td>6,758.5</td>
<td>-0.6</td>
<td>2.1</td>
<td>1.5</td>
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</tbody>
</table>

Quick Screening Results - ALCS Energy Estimation Tool (Version 1.0b7-NEEP-b01)
Project Specific Calculator

- Same calculation as the Quick Screening mode, but with no default assumptions
- Specify occupancy hours, windows and skylights, existing luminaires and controls
What’s Next

• Our Member utilities will be using it soon for their EE programs

• DLC will collecting user reports, requests on how to grow this tool further
  – Excel v. web tool?
  – Utility staff v. expanding pool of intended users?
  – Update underlying occupancy-space type data set with new ALCS data sets?
  – Program to check calculated predictions of the tool v. real-world experience?
DLC Lighting Controls Platform

- Demonstration Projects in Partnership with US DOE
- Networked Lighting Control QPL
- Training Programs for Designers and Installers
- Advanced Control Savings Calculator
- Lighting Control Savings Database
- New Rebates and Incentive Models
Lighting Controls Data Project

Overview

• Collect, Normalize, and Analyze Project Data from Manufacturers and Verified Case Studies
• Create database of Advanced Lighting Control savings
• Publish citable report of energy savings estimates from Advanced Controls

Objectives

• Develop assumptions to support utilities in developing new program offerings, rebates, incentives
• Refine savings assumptions of ALCS Energy Estimator Tool under development

Phase 1 Report coming September 2017
DLC Lighting Controls Platform

- Demonstration Projects in Partnership with US DOE
- Networked Lighting Control QPL
- Training Programs for Designers and Installers
- Advanced Control Savings Calculator
- Lighting Control Savings Database
- New Rebates and Incentive Models
Two Complementary Methods

Easy to use, prescriptive
- Works well with Luminaire Level Lighting Controls (LLLCs)
- DLC per Luminaire rebate PLUS
- Additional per luminaire rebate if controlled by DLC Qualified LLLC system

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?

High Volume

Low Volume
Programs that Require Networked Controls to be DLC Qualified

<table>
<thead>
<tr>
<th>With Special Promotions</th>
<th>No Special Promotions Yet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore Gas &amp; Electric (BGE)</td>
<td>Efficiency Smart (OH)</td>
</tr>
<tr>
<td>Con Edison</td>
<td>Efficiency Nova Scotia</td>
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<tr>
<td>Efficiency Maine</td>
<td>Eversource (CT)</td>
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<td>Efficiency Vermont</td>
<td>FortisBC</td>
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<td>Eversource (MA)</td>
<td>Hydro-Québec</td>
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<td>National Grid (MA, RI, NY)</td>
<td>New Hampshire Saves</td>
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<td>Southern Maryland Electric Cooperative</td>
<td>Public Service Company of New Mexico</td>
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<tr>
<td>United Illuminating Company</td>
<td>Sacramento Municipal Utility District</td>
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<tr>
<td>Wisconsin Focus on Energy</td>
<td>SaskPower</td>
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<tr>
<td>Idaho Power (starting 2018)</td>
<td>Xcel Energy (Colorado)</td>
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<tr>
<td>Pacific Gas &amp; Electric (starting 2018)</td>
<td>Xcel Energy (Minnesota)</td>
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<td>Xcel Energy (South Dakota)</td>
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<tr>
<td></td>
<td>Reading Municipal Light Dept. (MA)</td>
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</tbody>
</table>

*Based on survey data from approximately 45% of DLC Members*
Thank you!

Gabe Arnold
*DLC*

Damon Bosetti
*DLC*