Introduction

Commercial Lighting Solutions

• Integrated solutions are a necessity to achieve net zero energy buildings
• Next level of savings must come from daylighting, controls, expert design, *along* with high performance equipment
• The complexity of lighting, within the context of whole building design, is a microcosm of the larger challenge
• How can we make complexity scalable?
The Next Frontier

Cost, Complexity, Energy Savings

- T12 to T8 electronic retrofits
- HPT8 systems require low/normal/high ballast tuning
- Task-Ambient redesign
- “Intelligent Lighting” & advanced controls
- Solid State Lighting

Power Density → kWh

- 1995: Low Hanging Fruit
- 2005: Design Required
- 2015
- 2025

Lighting / Controls Supplier Summit
Key Partnerships

**Advanced Lighting Guidelines**
- Well-established tool for designers / A&E’s
- Applications Chapter being modified and expanded; “modules” will be consistent with Lighting Solutions
- Reference document, tremendous depth
- Managed by New Buildings Institute, with oversight from nationally renowned lighting experts and Advisory Committee

**Office of the Future (OTF)**
- Primarily utility membership, partnership creates a bridge to utility incentive programs
- CLS supports their Lighting Task Team
Lighting Solutions are Best Practices

- Development process
- Lighting experts provide high value solutions
- Provides both energy efficiency and quality
- Lighting Solutions = Design Vignette + Controls Strategy
- Specifications are actionable by nature, layered approach
  - Webtool audience are those who make lighting decisions, but may not be lighting experts
  - Implementation guidance (download packet) is geared towards design team
Criteria for Lighting Solutions

- IESNA design standards
- balance between progressive and trustworthy
- developed by design experts
- range of reasonable solutions
- input from end users
- targeted to audience
- performance specifications
- installation and commissioning guidance
- transparency
Limits of the Lighting Solutions

- Does not cover all spaces, we have picked a few that are typical and applicable
- This tool does not replace professional services, it just moves the needle to provide a very efficient strawman as a starting point to help leapfrog the learning curve
- We can only analyze what has been measured
  - Reliable data measuring energy savings from lighting control systems is not easy to come by, and we won’t make promises that can’t be verified from solid data and reliable sources
- We are seeking more data on lighting controls installation
Changing the metric

Power Density to kilowatt hours

• Lighting Power Density (LPD) focuses on power (kW), not time and cannot account for savings from controls
  – Limited to installed equipment
  – Does not address building actually operating
• Path forward must include combination of controls as well as reduced LPD
  – Reduce operating power (e.g., dimming)
  – Curtail operation (e.g., occupancy sensors, time clocks, etc…)
• CLS has a role in increasing usage of kWh-based utility and energy efficiency program rebates
Development - Conceptual Design

Specialty Market - Gondolas & Circulation

- Design Charrette
- Stakeholder input at Roundtable meeting #1
- Design Development, point by point calculations
- Stakeholder input at Roundtable meeting #2
- Incorporate designs into the webtool
Development- Calculations

Lighting Calculations were performed for each vignette, using AGI 32
Development- General Merchandise Vignettes

Perspectives RCP's Luminaires
Hello Carol Jones!

You can begin a new project or load an existing one.
CLS Webtool
CLS Webtool

Luminaires oriented parallel to shelves (Specialty Market)

**Lighting Power Density:** 1.68 W/ft²

**Concept**

Lighting Concepts for the General Sales area:
- Pendant-mounted lighting located in between and parallel with the gondolas provides both uplight on the ceiling and direct lighting on the product in a comfortably lighted atmosphere.
- In the main circulation paths, track mounted uplights provide ambient lighting.
- Accent lighting highlights specialty products and end caps.
- The store has medium height lay-in ceilings with skylights.

**Approach**

- Strategy
- Controls

**LUMINAIRES**

A) Cantilevered-linear fluorescent wall washing system mounted on top of gondoller at 77-67. Asymmetric distribution with separate symmetrical uplight (chamber located closest to shelves). Luminaires aiming. Luminaire efficiency: 40%. (2) 26 watt T8 fluorescent lamps (T826T3/835 PM Low Mercury).

B) Cantilevered-linear fluorescent wall washing system. Minimum MLPW of 70. Integral electronic 0-10 V.
CLS Webtool

Control Strategies
- **Nighttime dimming**
  Dimming ballasts will dim luminaires during evening and nighttime hours when customers eyes are adapted to less light. Demand reduction can be accommodated.
  Applies to: General Sales, Point-of-Sale.
  Duration: 4.25 hours
  Nighttime Dimming Details

- **Switching during stocking**
  During stocking hours, when less light is needed, half of the luminaires are switched off.
  Applies to: General Sales, Produce, Point-of-Sale, Bakery.
  Duration: 4 hours
  Switching during stocking details
Energy Analysis

Webtool Estimates Energy Savings

• Energy savings projections are shown against user-chosen baseline as they make selections
• Real-time tracking includes savings from daylighting and controls
• Uses various baselines to show energy savings against goals
• Current baselines include Std. 90.1 and IECC
## Actionable Implementation Instructions

### Luminaire Schedule

<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Photometry (Basis of Design)</th>
<th>Description</th>
<th># lamps in cross</th>
<th>Lamps</th>
<th>Initial Lamp Lumens</th>
<th>Ballast Type</th>
<th>Ballast Factor</th>
<th>Input Watts</th>
<th>Lamp/ Ballast MLPW</th>
<th>Luminaire Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMF 1s</td>
<td><img src="image" alt="Icon" /></td>
<td>Recessed 2x2 fluorescent basket fixture with integral electronic ballast. 20 gauge cold rolled steel housing with matte white finish, formed steel reflector and contoured acrylic lenses. Fixture dimensions: 23-3/4&quot; length, 23-3/4&quot; width, 6&quot; height.</td>
<td>2</td>
<td>F14T5/835</td>
<td>1200 @ 25°C</td>
<td>Electronic instant-start Ballast Efficiency: 82%</td>
<td>1.00</td>
<td>34</td>
<td>75</td>
<td>73%</td>
</tr>
<tr>
<td>RML 3s</td>
<td><img src="image" alt="Icon" /></td>
<td>Pendant mounted linear fluorescent direct fixture (93% downlight, 7% uplight) with specular baffles and integral electronic ballast. Extruded heavy gauge aluminum housing, specular aluminum reflector and baffles, natural aluminum finish. Fixture dimensions: 4' length. Bottom of fixture shall be 12'-0&quot; AFF.</td>
<td>1</td>
<td>FP28T5/835/PM Low</td>
<td>2500 @ 25°C</td>
<td>Electronic programmed rapid-start Ballast Efficiency: 84%</td>
<td>1.00</td>
<td>33</td>
<td>75</td>
<td>77%</td>
</tr>
<tr>
<td>RML 6d</td>
<td><img src="image" alt="Icon" /></td>
<td>Pendant-mounted linear fluorescent direct/indirect fixture (82% downlight, 18% uplight) with specular baffles and integral electronic ballast. Extruded heavy gauge aluminum housing, specular aluminum reflector and baffles, natural aluminum finish. Fixture dimensions: 4' length. Bottom of fixture shall be 12'-0&quot; AFF.</td>
<td>2</td>
<td>FP28T5/835/PM Low</td>
<td>2500 @ 25°C</td>
<td>Electronic programmed rapid-start Ballast Efficiency: 84%</td>
<td>1.00</td>
<td>66</td>
<td>75</td>
<td>81%</td>
</tr>
</tbody>
</table>
Focus on Offices is Next

- Solutions for 4 primary spaces - open plan, private office, conference room, corridors, at 2 different partition heights
- Key variables for Energy Efficiency

(3) Core Lighting Systems

- Recessed curved lensed 2x4 troffer
- Suspended linear fluorescent pendants (aka task-ambient or direct/indirect)
- Suspended linear fluorescent workstation-specific

Controls Strategies

- Daylight dimming, occupancy sensors, vacancy sensors, personal dimming, time controls, digital
Snapshot of CLS for Offices

Recessed Non-Planar Lensed Troffers

- Improvement from the traditional flat lens or parabolic
- Softens distribution, more comfortable and aesthetically appealing (sometimes called “volumetric brightness”)
- Numerous versions, they are not all created equal
- Eliminates the cave effect
- Reduces overhead glare
Snapshot of CLS for Offices

Recessed Non-Planar Lensed Troffers

Acuity Lighting
Snapshot of CLS for Offices

Direct / Indirect in Continuous Rows

• Provides room surface brightness using direct/indirect pendant lighting fixtures. Light levels in the room can be slightly reduced when local task lighting is provided.
• Study showed 10-15% improvement in occupant comfort.
• Energy savings from fewer fixtures installed, newest component technology, and reduced ambient light levels.
• Daylighting Controls to be integrated in the perimeter zones.
• There are many varieties of options, but only a subset of the best performing fixtures will meet the performance specification.
Snapshot of CLS for Offices

Direct / Indirect in Continuous Rows

USGBC Headquarters, Lighting & Daylighting Design by Clanton & Associates, Inc.
Snapshot of CLS for Offices

Workstation-specific “Intelligent Lighting”

• Workstation-specific fixtures with constant indirect lighting and personally controlled downlight resulted in 20% improvement in occupant comfort.

• Dramatic energy savings from fewer fixtures, occupancy sensors, daylight dimming, peak load demand response, and personal control by user.

• Separate lighting systems are required for transition areas. Plan carefully to ensure proper commissioning and maintenance.

• Scientifically measured improvements in worker motivation and performance.
Snapshot of CLS for Offices

Workstation-specific “Intelligent Lighting”

GSA, 450 Golden Gate, San Francisco, CA
Pathway to Incentives

Next steps: project data collection interface

• End user will luminaire schedule with controls data; tool will calculate more accurate projected savings
• Second pass at savings calculations increases accuracy by using actual project data
• Documentation can be used to submit for utility and energy efficiency program rebates
• Working with numerous utilities to determine their requirements for using CLS within their programs
Additional Resources

Where to find CLS and related materials…

Commercial Lighting Solutions, Lightfair booth #3089

Commercial Lighting Solutions:  
http://buildings.energy.gov/commercial_initiative/research.html

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