Lighting Best Practices

Smart and simple lighting upgrades for Prop 39 projects
Contents

• Introductions
• The Educator’s Challenge
• Digital Lighting Systems 101
• Best Practices For Campus Relighting
  – Key Applications
  – Lighting Renovation Process
• Lifecycle Cost Tool
• Resources
• Contact info
At Acuity Brands, we deliver high-quality, energy-efficient, integrated lighting systems that improve the education experience and reduce operational costs. From the classroom to the gymnasium, from the parking lot to the laboratory, from pre-schools to grad schools, we help institutions achieve enhanced learning environments, increase energy savings, reduce operational costs and improve sustainability.

**Lighting Brands**

- Lithonia Lighting
- acculamp
- AEL American Electric Lighting
- DTL Dark To Light
- ANTIQUE Street Lamps
- CARANDINI
- g gotham
- Pathway Connectivity Solutions
- HEALTHCARE Lighting
- HOLOPHANE
- HYDREL
- ROAM
- MARK Architectural Lighting
- PEERLESS
- tersen

**Controls & Daylighting Brands**

- ADURA Technologies
- RELOC Wiring Solutions
- SensorSwitch
- Synergy Lighting Controls
- Sunoptics
- Winona Lighting
Acuity Brands: California Connection

• Key brands headquartered in California
  – Adura Controls (San Francisco)
  – Hydrel (Los Angeles)
  – Lighting Control & Design (Los Angeles)
  – Peerless (Berkeley)
  – Sunoptics (Sacramento)

• Manufacturing and distribution centers in Los Angeles, Sacramento

• Agency partners in Fresno, Los Angeles, San Diego, San Francisco, Sacramento, Ventura

• About 350 employees in California
The Educator’s Challenge
The Educator’s Challenge

Improve Outcomes

Reduce Costs
Education Renovation Mandate

- **Key Drivers**
  - Average school building is now 40+ years old
  - Changing teaching methods require adaptive lighting
  - Recession caused huge backlog of deferred maintenance
  - Demand for sustainable facilities is insatiable
  - Requirement to reduce maintenance is an imperative
- **The Opportunity**
  - With Prop 39 funding and strategic action, Californians can make dramatic improvements in the learning environment
Digital Lighting Systems 101
Lighting is the Big Opportunity

Schools and Colleges – Electricity Consumption by Usage Type

- Lighting (Interior & Exterior) 44%
- Cooling
- Ventilation
- Office Equipment
- Refrigeration
- Misc.
- Heat
- Motors
- Cooking
- Water Heating

Source: California Energy Commission, California Commercial End Use Survey, 2006
Where Do We Spend Our Lighting Energy?

Data Logger Report:
Turn off unused lighting to save 44%.

Wasted Energy – Large University Building

- Restroom
- Hallway
- Classroom
- Janitor Closet
- Copy Room
- Library
- Office
- Lobby

Lights On  Occupied
Key Questions for Lighting Renovation

Current State: What do you look for?
• Outdated T12 or T8 fluorescent parabolics, troffers or strips
• Incandescent in emergency lighting, downlighting or trophy cases
• Metal halide or high pressure sodium fixtures outdoor or in gyms
• Areas where lighting is on but not needed (i.e., no lighting controls)

Future State: What do you want?
• Economic improvement: energy reduction, lower total lifecycle cost
• Aesthetic improvements for both visual acuity for the task at hand and for campus appearance
• Functional improvement: Easier, more flexible lighting operation both in individual spaces and as an overall campus
If Energy Cost is the Only Concern …
… Just Turn Off All the Lights
Where do we want to focus our energy?

Improved Outcomes

Productivity Gains from High Performance Lighting Systems

- T8/T5 LAMPS, ELECTRONIC BALLASTS, AND/OR HIGH PERFORMANCE FIXTURES: 13.2%
- INDIRECT LIGHTING FIXTURES: 26.1%
- INCREASED LIGHT LEVELS: 6.0%
- DAYLIGHT SIMULATING SKYLIGHT: 2.0%

SOURCE:
Carnegie Mellon University Center for Building Performance, 2005
High performance lighting solutions deliver:

- the right kind of light,
- the right amount of light,
- exactly where you need it,
- and only when you need it,
- at the lowest total lifecycle cost.
High Performance Lighting System Components

1. LED Sources
2. Smart Controls
3. Useful & Usable Software
#1: LED Sources

Obvious Benefits
- Low energy consumption
- Long-life (80,000+ hours)
- Dimmability
- Lower temperature
- Color-control
- Instant start

Other Benefits:
- New form factors
- Next generation (i.e., OLED)
- Redefining the meaning of a light fixture
#2. Smart and Integrated Controls
#3. Useful and Usable Software

- Point-and-click commissioning
- Remote control & administration
- Desktop, web & mobile apps
- BACnet compatible
Digital lighting networks allow you to …

Program Your Lights

… to do what you want them to do.

- Tailored lighting where & when needed
- Adaptive scenes to respond to changing conditions and occupant needs
- Meet high performance standards, such as LEED, Title 24, CHPS, etc.
- Minimize long-term total cost of building ownership and operation
- The building is a teaching tool, with reporting and tracking
- Minimize energy & environmental impact
- Minimize maintenance requirements
- Respond to load management requirements
- Easy to implement in new construction or renovation projects
Key Applications
Classroom Lighting Design Objectives

Students
• The right amount of light for the task at hand
• Improved visibility and visual comfort to aid in recognition and legibility

Teachers
• Enable learning activities
• Simple, intuitive operation
• Reduce off-task behavior
• Improve mood, concentration
• Reliability

Administrators
• Improve teaching outcomes
• Minimize energy use
• Lower maintenance burden
• Comply with codes, standards, budgets
Classroom Guidelines and Standards

The Basics

• Carefully define the required lighting to maximize visibility and visual comfort
• Put the right amount of light where it is needed, when it is needed
• Avoid glare
• Light the ceiling and walls
• Blend electric lighting and daylighting
• Provide good color rendition
• Simplify scenes and controls

Additional

• Standardize when possible (including lamps, ballasts and controls)
• Consider ease of maintenance (including fixture locations and access, fixture cleaning requirements, and re-lamping efforts)
• Maximize potential of proven technologies

Illumination Levels *

<table>
<thead>
<tr>
<th>Classrooms</th>
<th>Horizontal fc Targets</th>
<th>Vertical fc Targets</th>
<th>H/V Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;25</td>
<td>25-65</td>
<td>&gt;65</td>
</tr>
<tr>
<td>Learning/teaching</td>
<td>25</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Audiovisual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chalkboard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated VDT Screens</td>
<td>75</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>Hardcopy and Writing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulletin Board</td>
<td>200</td>
<td>400</td>
<td>800</td>
</tr>
<tr>
<td>Whiteboard</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Typical Best Practice for Classrooms

- LED Luminaires
- Smart Sensors and Controls
- Simple Software
Classroom Lighting – Before
Classroom Lighting – After Relighting
Parking Structures and Parking Lots

HID Application

LED Application
For Outdoor, Insist on a Control Capability
For Outdoor, Insist on Precise Optical Control

- Light only those areas that need to be lighted.
- Minimize site lighting with a purposeful approach
- Consider full cutoff fixtures, low-reflectance surfaces and low-angle directional outdoor lighting

Example of full cut-off option on Lithonia Lighting D Series LED area light
Gymnasium (Before)
Gymnasium (After)
Bathrooms
Bathrooms (Sensors)
(Also applies to small offices)

Design Challenge
• Lights are always on, but space is mostly unoccupied
• Traditional occupancy sensors can’t see through walls

Design Solution
• Passive Dual Technology (Infrared and microphonics) provides overlapping detection of human activity over the complete PIR coverage area
Process Best Practices

• Vision and strategic plan
  – Engage the full team to shape a shared vision and goals

• Do your homework
  – Inventory and audit facilities
  – Get expert advice on layouts, lighting selection, controls choices
  – Engage institution leadership, including CFO
  – Engage your utility partners (rebates, advice)
  – Engage your peers for best practices

• Prioritize high-impact applications
  – Economic and photometric evaluation
  – Pilots, trial installations, validate results
  – Scale the application solution across campus and district
Total Lifecycle Cost Assessment Tool
Lifecycle Cost Assessment Tools

• Simple tool to determine economic value of a lighting system
• Free, web-based, user-friendly design tool
• Based on IESNA RP-31-1996 “Recommended Practice for the Economic Analysis of Lighting” standards
• Available at www.Visual-3D.com
Lifecycle Cost Assessment Tools

Visual 2012
includes quick and powerful rendering capabilities
to allow you and your customer to visualize the
lighting design

Visual 2012
Download

Design Tools
Wallwash Tool
Determine tilt and spacing for
wallwash applications

Support
Training Videos
Knowledgebase
Lifecycle Cost Assessment Tools
Interior Tool: Determine Counts and Layout

**Visual Interior Tool™**

**Calculation Results**
- Illuminance: 76 fc
- Power Density: 1.03 W/ft²
- Quantity: 30

**Spacing Results**
- Spacing: 16.6 x 12 ft
- Arrangement: 6 x 5
- Outside Spacing X: 6.75 ft
- Outside Spacing Y: 5.25 ft

**Comparison**

<table>
<thead>
<tr>
<th>Luminaire</th>
<th>FC</th>
<th>W/FT²</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>73</td>
<td>1.58</td>
<td>32</td>
</tr>
<tr>
<td>B</td>
<td>75</td>
<td>1.33</td>
<td>32</td>
</tr>
<tr>
<td>C</td>
<td>76</td>
<td>1.03</td>
<td>30</td>
</tr>
</tbody>
</table>

**Display**
- Dimensions Room [ ] Layout [ ]
- Show Zonal Cavity Info [ ]

You can now click and drag to rotate the room.
Economic Tool: Import Layout
Economic Tool: Import Layout & Set Parameters
Economic Tool: Set Properties for Each System

For each system, establish costs for new equipment, maintenance and replacement parts.

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Life Cycle (years)</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discount Rate (%)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Electricity Rate (¢/kWh)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Electricity Escalation (%/yr)</td>
<td></td>
</tr>
<tr>
<td>Hours of Operation</td>
<td>Weekday (hr/day)</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Weekend (hr/day)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Annual (hr/year)</td>
<td>3337</td>
</tr>
<tr>
<td>Labor Rates</td>
<td>Installation ($/hr)</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Ballast Replacement ($/hr)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Lamp Replacement ($/hr)</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Cleaning ($/hr)</td>
<td>15</td>
</tr>
<tr>
<td>HVAC</td>
<td>Cooling Hours</td>
<td>935</td>
</tr>
<tr>
<td></td>
<td>Heating Hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost per Thrm (¢ / thrm)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Heat Initial Savings ($/thrm)</td>
<td>2</td>
</tr>
<tr>
<td>Taxes</td>
<td>Local Sales Tax (%)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Income Tax Rate (%)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Depreciation (years)</td>
<td>10</td>
</tr>
<tr>
<td>Project</td>
<td>Disable Auto Calculate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explanation Window</td>
<td></td>
</tr>
<tr>
<td></td>
<td>View Results As Delta</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Copy System</td>
<td></td>
</tr>
</tbody>
</table>

Visual Economic Tool™

System 1
- Baseline System: checked
- Quantity: 32

System 2
- Baseline System: unchecked
- Quantity: 32

System 3
- Baseline System: unchecked
- Quantity: 30

Photometric File
- Manufacturer: Lithonia Lighting
- Catalog: TH 250M PA22E (LEG 4,5xC 1,5)
- Total Wattage: 297
- Number of Lamps: 1
- Cost: $50
- Other Costs: 100%
- HVAC - Inactive

Photometric File
- Manufacturer: Lithonia Lighting
- Catalog: FGB1144 54T5HO FI120U
- Total Wattage: 249.5
- Number of Lamps: 4
- Cost: $30
- Other Costs: 100%
- HVAC - Inactive

Photometric File
- Manufacturer: Lithonia Lighting
- Catalog: IBL 18L WD LP740 DLC
- Total Wattage: 207
- Number of Lamps: 1
- Cost: $15
- Other Costs: 100%
- HVAC - Inactive
For each system, establish savings from variety of available controls tactics.
Economic Tool: Evaluate Cost Comparison

For each system, compare costs, including a variety of perspectives … financial, operational, environmental.
Economic Tool: Evaluate Cost Comparison

Data can be viewed as a variety of graphs and reports can be saved as PDF.
Resources
Educator Resources

- AcuityBrands.com
- Trial installation program
- On-site mockups
- Visual Economic Tool (www.visual-3d.com)
- Sensor Switch DataLogger
- Your local lighting agency

- K-12 Lighting Renovation Workshop
- Training and demo centers in Los Angeles, San Francisco, Berkeley, Sacramento
- Case studies & design guides
Contact Information

- Web site: www.AcuityBrands.com/Schools

- Tim Hogan
  E-mail: tim@acuitybrands.com
  Cell: 678-237-7536
Thank You