# Lighting Retrofits

Sustainability Best Practices for Lighting Retrofits

Cal Poly State University, San Luis Obispo

Presented to the UC/CSU/CCC Sustainability Conference

June 23, 2009

Presented by
Dennis K. Elliot, PE, CEM
Sustainability Manager

# Lighting Retrofits

Cal Poly San Luis Obispo

Founded 1901

- Wide variety of lighting systems
- Major retrofit in 2001 to T8 and electronic ballasts
- Underwent campus wide energy audit in 2007 – 2008
- Identified numerous opportunities for lighting retrofit and redesign
- Worked with PIER and CLTC to implement 9 interior and exterior lighting technology demonstration projects for the 2008 Sustainability Conference, as well as educate our ESCO

# Lighting Retrofits

## Smart Bi-Level Stairwell Fixtures

- Stairwells must be lit 24/7 for safety and egress
- Stairwell occupancy is intermittent and cyclical – may be empty 95% of the day
- Occu-Smart fixtures installed in 6 towers of Sierra Madre Hall, and Faculty Offices East
- System integrates ultrasonic motion sensors and dimmable ballasts into stairwell fixtures
- Dims to 20% output when not occupied, ramps up to full output if motion is detected – enhances security
- Reduced energy consumption by 90%

# Lighting Retrofits

## IOLS – Integrated Office Lighting System

Design approach – reduce overhead lighting, and utilize high efficiency task lighting

- Implemented in 10 private offices and 2 open work areas

Before:

- Parabolic troffers with 2, 3, or 4 32W T8 lamps, 3500K
- "Glare bombs" – poor light distribution, glare on computer screens, users resorted to delamping to reduce glare
- Average energy use – 110W per fixture

# Lighting Retrofits

## IOLS – Integrated Office Lighting System

After:

- Lithonia RT5R troffer retrofit kits
- 2 lamps per fixture – 28W T5, 4100K
- Step dimming ballasts – most used at 50% output – 34W per fixture – 70% reduction
- "Volumetric" fixture with direct/indirect lens and reflector provides much improved distribution and uniformity, reduced glare
- Higher color temperature resulted in higher perceived light levels
- Lithonia RT8 now available, and has become the campus standard

# Lighting Retrofits

IOLS – Integrated Office Lighting System

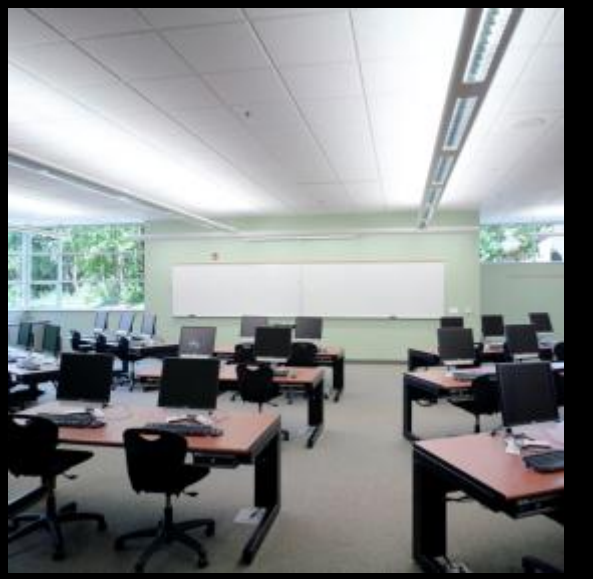
Task Lighting:

- Finelite PLS – Personal Lighting System
- System of LED desk lamps and undercabinet lamps 6, 9, or 12W
- Easily customized – single power supply per office
- Remote mount PIR motion sensor mounts under desk surface
- Very popular with users – some don't use overhead lighting at all
- Total office lighting energy use reduced by 80%

# Lighting Retrofits

ICLS – Integrated Classroom Lighting System

- Pendant mounted fixtures with separately switched uplight and downlight to provide direct/indirect light – T8 lamps
- Separate circuit for projector screen or whiteboard fixtures
- Dual technology motion sensors – PIR and ultrasonic
- Modes: general instruction mode, A/V mode, 1 hour quite time override (prevents motion sensors from turning lights off), optional dimming capability
- Teacher control panel at front of classroom

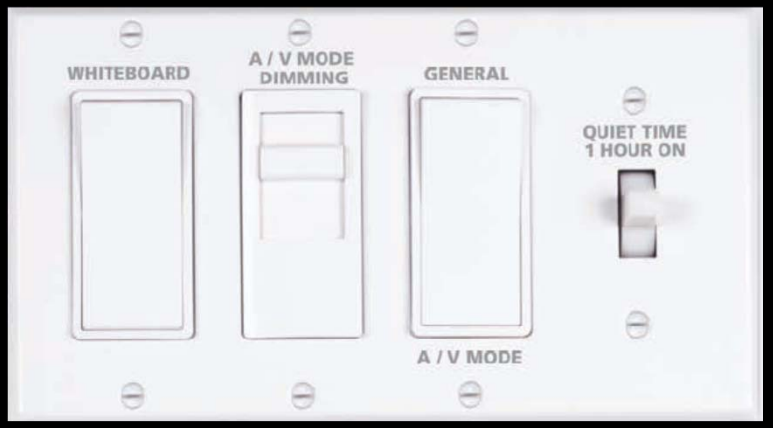


# Lighting Retrofits

## ICLS – Integrated Classroom Lighting System

Two ICLS systems installed

- Science E27 auditorium lecture hall
  - Used direct/indirect fixture with whiteboard fixture and A/V mode
  - Lighting energy reduced by 50%
- Facility Services conference room
  - Unusual application – 8 ft ceiling -used short pendants
  - Uplight only, with dimmable ballasts
  - Replaced 16 32W T8 lamps and 6 incandescent floods with 10 32W T8 lamps
  - Improved light distribution and uniformity
  - Lighting energy reduced by 30%




# Lighting Retrofits

## Hybrid Bathroom LED Light Switch

- Many hotel/dorm users leave a bathroom light on at night
- Hybrid LED switch integrates a PIR motion sensor and 2 watt LED night light
- Users can use the bathroom at night without turning overhead lights on
- Occ sensors ensures lights cannot be left on
- Installed in 50 bathrooms in Cerro Vista Apartments
- Reduced energy use by 50%

# Lighting Retrofits

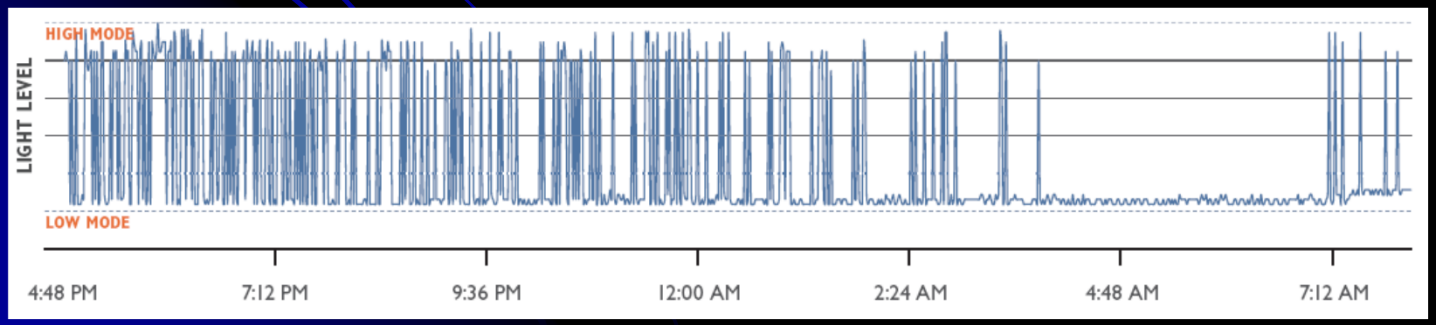
## Smart Bi-Level LED Bollards

- Replaced 50W HPS walkway and area lights with 41W LED bollards
- Diffuser designed to take advantage of directional nature of LED source
- Use microwave motion sensing technology
- Dim to 8W when no motion is detected
- Long lamp life – up to 100,000 hours
- Used 180 degree pattern for walkway lights near building windows
- Reduced energy use by 70%

# Lighting Retrofits

## Smart Bi-Level LED and HID Streetlights

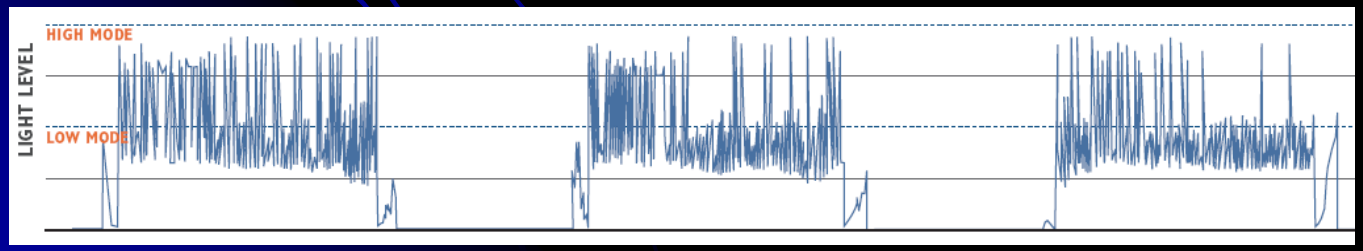
- Cerro Vista - 100W HPS shoebox lights replaced with:
- 80W bi-level LED – dim down to 35% when no motion is detected
- 150W HID – dim down to 50% when no motion is detected
- Both produced higher quality light and color rendition
- Reduced energy consumption by 40%




# Lighting Retrofits

## Smart Bi-Level Induction Streetlights

- Parking Lot H4
- Replaced 250W HPS with bi-level 100W induction lamps
- PIR motion sensor on pole provides 270 degree coverage
- Dim to 50% when no motion is detected
- Much improved light quality and color rendition
- 100,000 hr lamp life
- Motion sensors provide enhanced security
- Reduced energy use by 74%




# Lighting Retrofits

## Lessons Learned

- Scotopic vs Photopic light – color rendition can be more important than measured light level
- Raise your color temperature, but don't mix
- Be careful in application of LED's – exposed sources are extremely bright and can be harsh
- LED's claim very long lamp life, but it is the driver that fails first – design of heat sink is critical
- Smart bi-level technologies don't gain full benefit in high traffic areas
- Outreach and education is critical before you change users environment

LED
141 watts
8400 lumens
CRI 75

HPS
300 watts
21000 lumens
CRI 22

# Lighting Retrofits

## Contacts and References

Dennis Elliot, Sustainability Manager, Cal Poly SLO, delliot@calpoly.edu

PIER Program – http://www.energy.ca.gov/research/index.html

CLTC – www.cltc.ucdavis.edu

Smart Bi-Level Stairwell fixtures - www.occu-smart.com

ICLS/PLS – www.finelite.com

LED Bollards – www.sitelighting.com

Hybrid LED Wall Switch – www.wattstopper.com

Bi-level induction streetlights - www.fullspectrumsolutions.com

BI-level LED Streetlights – www.betaled.com

PIER Demo Sites via Google Earth - http://www.terradex.com/PublicPages/CIEE/pier-01.kmz