



# 2008 Nonresidential Standards Lighting Change Proposals

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# PIER Research



- Lighting Research Program (LRP)
- High Performance Commercial Building Systems (HPCBS)
- Change proposals limited to:
  - Nonresidential
  - High-rise Residential
  - Hotel / Motel



# Lighting Measure Templates



- LED Exterior Lighting
- Load Shedding Ballasts
- LED Night Lighting in Bathrooms
- Integrated Classroom Lighting
- Bi-level Stairwell Lighting



# LED Exterior Lighting



Normal operation both the LED and conventional lamp operate.

During periods of non-occupancy, only the LED operates.





# LED Exterior Lighting



## Common Features

- Conventional Incandescent or Fluorescent Lamp
- LED Arrays
- Photocell Control
- Activated by occupancy sensor
- Integrated System



# LED Exterior Lighting



- The fixtures save energy by switching on the incandescent or fluorescent lamp only when motion is detected.
- The fixtures provide pleasant, ambient LED background light, eliminating dark spots commonly associated with motion sensor systems.
- When the primary lamp burns out, the LED will still yield functional light from the fixture.
- The use of incandescent or fluorescent lamps eliminates the need for higher lumen output, (more) expensive LED arrays.
- The use of colored LEDs provides a 'color changing' feature as an added security benefit.



# LED Exterior Lighting



## Features

- LED uses 5 watts continuous all night long
- 87% savings over Incandescent
- Can use CFL, but payback increase to 5 years.
- In marketplace since 2004.



# LED Exterior Lighting



## Proposed Changes

- Add new Power Adjustment Factor (PAF) table for outdoor lighting in Section 147.
- Include 50% PAF credit for Hybrid fixture.
- Should be considered for Residential Applications.



# LED Exterior Lighting



## Savings Calculation

- CFL Based design with lighting always on:
  - 10 lamps @ 15 watts = **150 watts**.
  - 12 hrs operation X 365 days x 150 watts = **657 kWh/yr**
- LED / Incandescent hybrid based design:
  - 10 lamps @ 60 watts = 600 watts.
  - 10 lamps @ 5 watts = 50 watts.      x **0.50** PAF = **325 watts**
  - 12 hrs operation x 365 days x 600 watts x 13% = **342 kWh/yr**.
- If PAF were 0.75, both designs would have equivalency under Title 24, yet the hybrid would still use 1/2 the power.



# LED Exterior Lighting



## Eligibility Criteria

- Primary light source controlled by occupancy sensor.
- Secondary light source is LED.
- Secondary light source is Always On.
- Entire system integrated with Photosensor.
- Limited to Pedestrian Area applications.



# LED Exterior Lighting

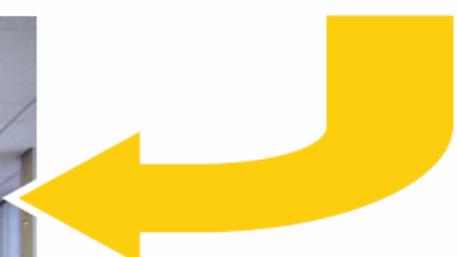
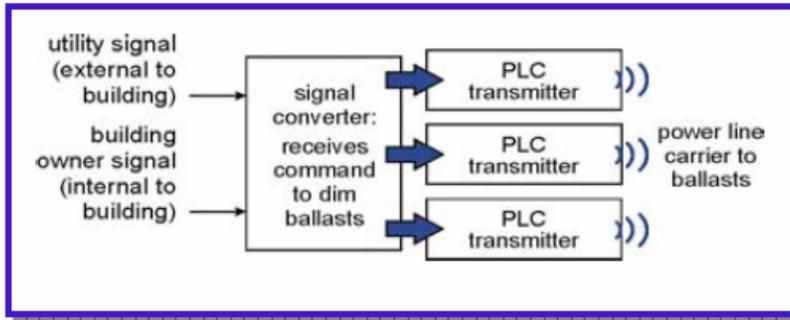


## Applications

- If limited to Pedestrian Area, changes in Section 132 language not needed. (50% switching)
- If allowed in parking lots, exemption needed since LED is not turned off.
- Comments?



# Load Shedding Ballasts





# Load Shedding Ballasts



- Switched capacitor circuit
- Lamp current reduced by 35%
- Produces 33% reduction in lamp power.
- Uses power line carrier signaling method.
- \$9.00 incremental cost per ballast.
- Payback in less than 3 years.



# Load Shedding Ballasts



## Proposed Changes

- New entry in Table 146-A Power Adjustment Factors (PAF) for Indoor Lighting.
- Entries currently cover Automatic Load Control with Dimming – Credit given is 25%
- No user controlled dimming available, apply 15% PAF.



# Load Shedding Ballasts

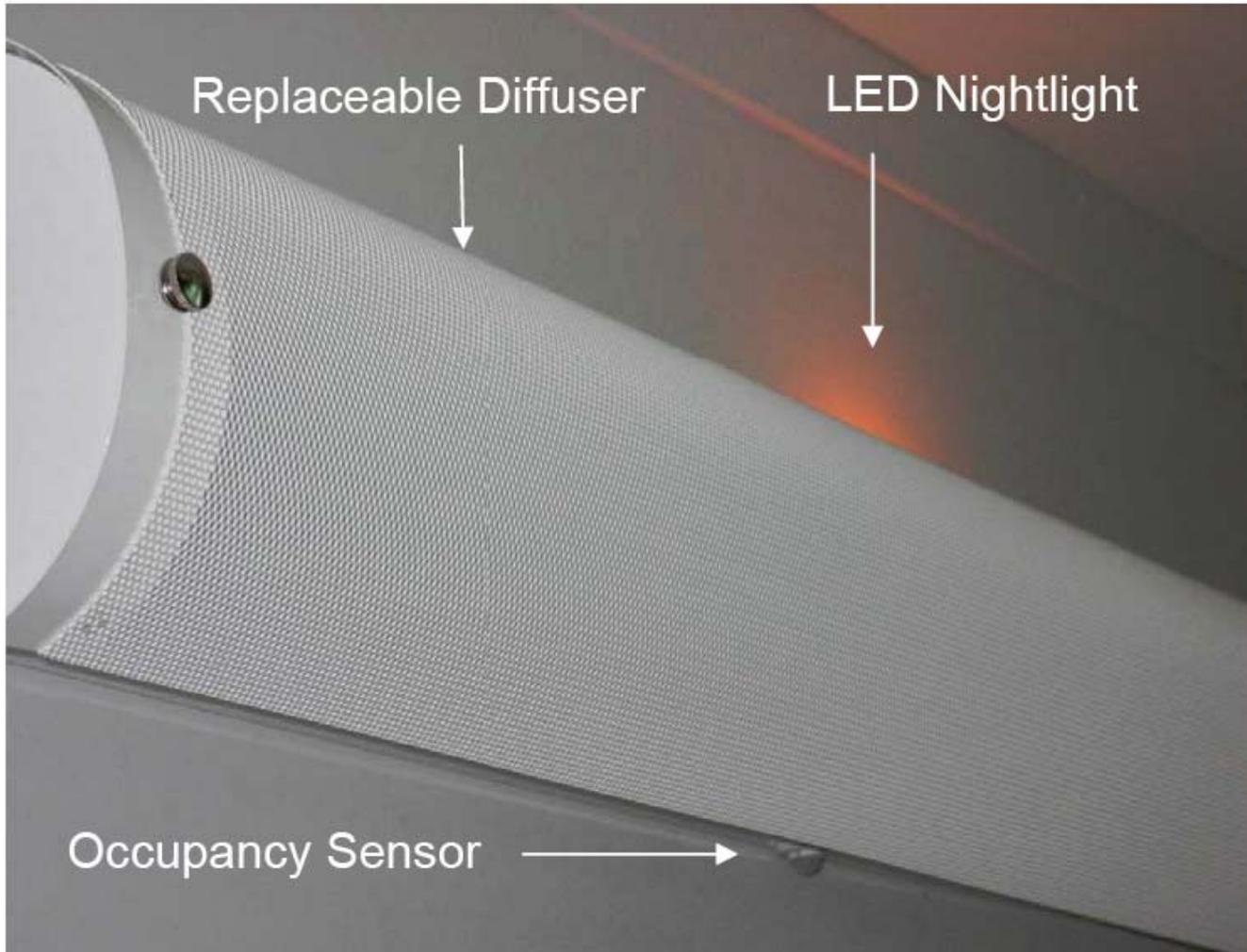


## Eligibility Criteria

- Minimum Ballast Efficacy Factor (BEF) = 1.48
- Must have a control system that is ready to respond to a load curtailment or real time pricing signal.
- All lights receiving the control credit must be controlled.
- Each light that qualifies for this credit must be equipped with a load shedding ballast that will respond to the signal to dim the lights.
- Each light must provide a minimum 30% reduction in lighting input power upon receiving the signal.



# LED Night Lighting in Bathrooms





# LED Night Lighting in Bathrooms



## Features

- Conventional luminaire
- Occupancy Sensor
- Low power LED (less than 1 watt)



# LED Night Lighting in Bathrooms



## Benefits

- Occupancy sensor reduces lights left on.
- LED serves as nightlight.
- LED can be used as safety light during power outages.
- 50-75% energy savings.
- 2-6 year simple payback.



# LED Night Lighting in Bathrooms



- Section 150 in current Title 24 considers LED as low efficacy light source.
- Low efficacy light sources in bathrooms must be on Occupancy Sensor.
- Products currently made not able to be installed in California, new construction or retrofit.



# LED Night Lighting in Bathrooms



## Change Proposal

- Modify Table 150-C in Section 150.
- Include entry that permits the lower efficacy LEDs for low wattage applications.
- Will still exclude incandescent.

*Standards Table 150-C*

Lamp Power Rating	Minimum Lamp Efficacy
5 watts or less	30 lumens per watt
Over 5 watts to 15 watts	40 lumens per watt
Over 15 watts to 40 watts	50 lumens per watt
Over 40 watts	60 lumens per watt



# Integrated Classroom Lighting





# Integrated Classroom Lighting



- High performance lighting system.
- Products currently in marketplace.
- Direct/Indirect luminaries.
- 96% reflective material.





# Integrated Classroom Lighting



- Teacher control features
  - General Lighting
  - A/V Mode w/dimming
- Occupancy Sensors
- Plug and Play configuration

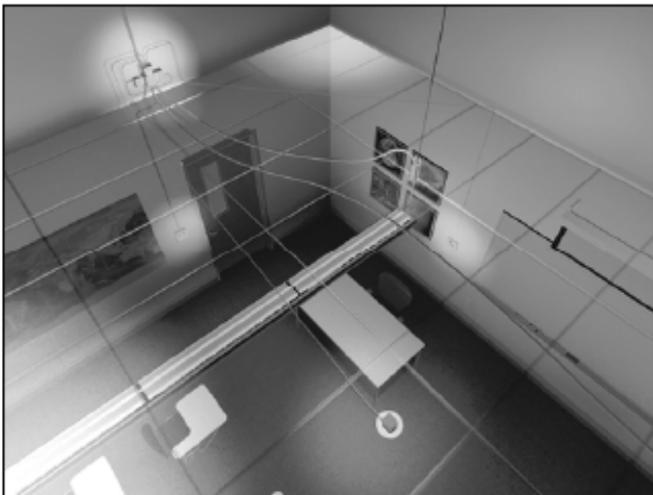


Teacher Control Center w/ Quiet Time



Dual Technology Occupancy Sensor

Low Voltage Plug  
together wiring





# Integrated Classroom Lighting



- Installed in 6 schools in California, 19 classrooms.
- 40 – 70 fc on student desks.
- Resulting LPD = 0.95 w/sqft.
- With Occupancy Sensors – 0.76 w/sqft.
- Current Title 24 = 1.2 w/sqft.
- 36% better than code.



# Integrated Classroom Lighting



- Positive responses from teachers on quality of light.
- Higher cost per fixture than conventional lighting.
- Lower installed system cost due to high quality luminaires, reduced number of fixtures, plug and play design.
- \$3.31/s.f. - \$4.31/s.f. cost (Good - Best)



# Integrated Classroom Lighting



## Change Proposal

- Revise Allowed LPD Tables
  - Table 146-B Complete Building Method
  - Table 146-C Area Category
- Lower school allowed LPD from 1.2 w/sqft to 1.1 w/sqft.
- Lower classroom allowed LPD from 1.2 w/sqft to 1.1 w/sqft.



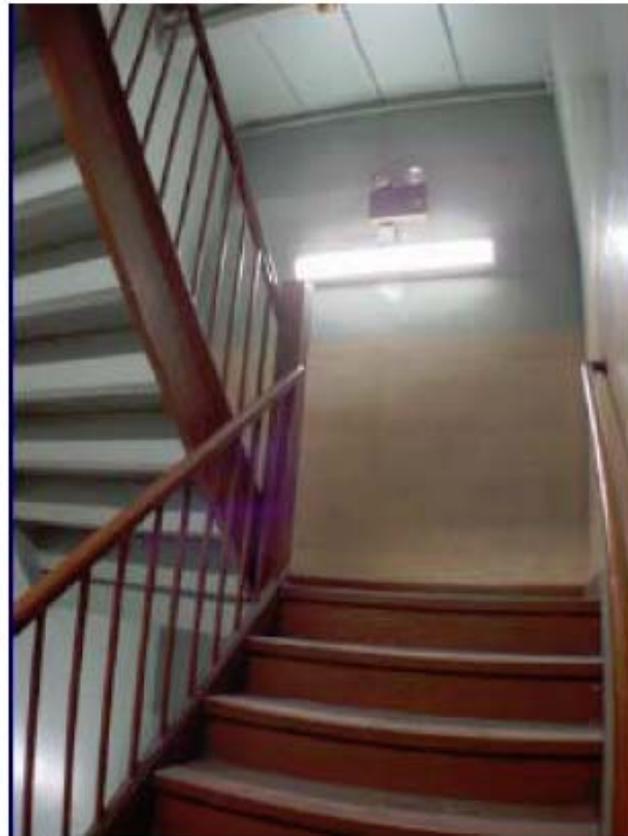
# Integrated Classroom Lighting



- Should it be reduced to 1.0 w/sqft??
- Adding occupancy sensors to the ICLS system reduces the effective LPD to 0.76 w/sqft (20% PAF)
- Would still beat Title 24 by 24%!



# Bi-Level Stairwell Lighting





# Bi-Level Stairwell Lighting



- Stairwells typically lit 24/7 for egress purposes.
- Low occupancy (0.7 - 3.3 percent)
- Reduces light level to code minimums when unoccupied.
- Returns lighting to 100% upon occupancy detection.
- Uses 1/3 or less power most of the time.



# Bi-Level Stairwell Lighting



- Lighting Research Center (Rensselaer Polytechnic Institute)
  - High-rise residential applications
  - High-rise office applications
  - 53 to 60 percent savings
  - 2.5 year payback



# Bi-Level Stairwell Lighting



## ■ LBNL Study

- 3 Office buildings
- University building
- 40 – 60 percent energy savings
- 5 year payback or less



# Bi-Level Stairwell Lighting



## Proposed Changes

- New entry in Table 146-A Power Adjustment Factors (PAF) for Indoor Lighting.
- Entries currently cover
  - Hallways of hotel/motels
  - Commercial & industrial storage stacks
  - Library stacks
- Apply 25% PAF (same as hallways).



# Bi-Level Stairwell Lighting



## Eligibility Criteria

- Applicable only to stairwells.
- Controlled by occupant sensing device.
- Multi-level switch or dimming system.
- Reduces the lighting power at least 50% during periods of non-occupancy.
- Minimum ballast efficacy factor (BEF) = 1.48