



Lighting Research Program Technology Highlights

E Source Members Forum
November 2004

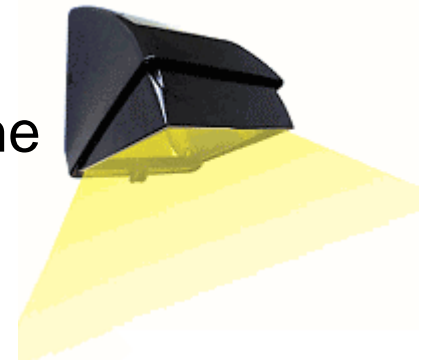
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Architectural Energy Corporation**



What is the Lighting Research Program?

- a two-year \$5.2 million R&D program
 - focused on developing and introducing energy-efficient lighting technologies into the marketplace.
- a set of diverse projects
 - includes 15 technical and three market connection projects.
- a unique partnership sponsored by the California Energy Commission
 - managed by Architectural Energy Corporation; involves various researchers and manufacturers.





What Is the Value of the LRP?

For California citizens, the LRP provides the opportunity to:

- save energy, lower peak electricity demand, and reduce pollution.
- integrate research with market connection activities.
- leverage expertise and co-funding from lighting manufacturers.





Featured Lighting Technologies

- Integrated Classroom Lighting Systems
- Load Shedding Ballast Technology
- LED Exterior Fixtures





Integrated Classroom Lighting System

Product: *A high-performance lighting system with integrated sensors and controls for classrooms and training facilities.*

'Basic' Option

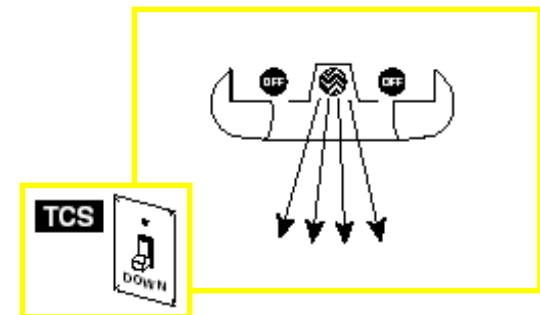
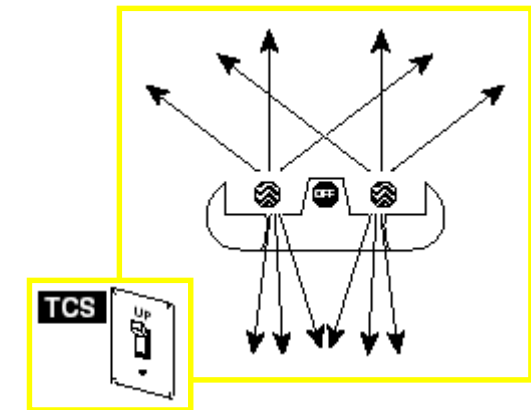
- Direct/indirect fixtures with super T8 lamps.
- Uses 96% reflective white paint to improve fixture efficiency.
- Two rows of fixtures for maximum savings.
- Manually switched rows for daylighting control.
- Ballast factor managed to maximize savings with two rows.



Integrated Classroom Lighting System

'Better' and 'Best' Options

- Dimming with teacher control switch (TCS) to lower light levels (5 fc) for A/V presentations.
- Addition of photosensors to provide automatic daylight control.
- Third row of fixtures added for better uniformity on desks, ceilings, and walls.
- Ballast factor managed to maximize savings with three rows.





Integrated Classroom Lighting System

A total of **nineteen** test classrooms and one office meeting room have been installed in California.



Energy Use *Before*
1.75 watts / sq foot



After
0.85 watts / sq foot



Integrated Classroom Lighting System



Benefits

- Reduced energy use by 30 to 50%.
- Reduced glare and eyestrain for teachers and students.
- Improved light levels on teaching walls.
- Increased teacher satisfaction through better controls.

Second project underway with LAUSD and SCE.



Integrated Classroom Lighting System



Economics

- Installed cost (\$2.71/sqft) for a two row system is less than a typical layout of 15 Parabolic Troffers (\$2.86/sqft).
- The “best” system (3 rows with A/V) is approximately \$3.81/sqft.

Two row system helps school districts stay within construction budget yet provide quality lighting.

Note: Manufacturers are Finelite and The Watt Stopper



Energy Efficient Load Shedding Technology

Product: *A cost effective, energy efficient instant-start ballast for reducing power demand by dimming fluorescent lighting (T-8 lamps) from a centralized point of control.*

- Purpose is to manage load on the electrical grid -- to be used by electricity suppliers (grid operators) as a substitute for power generating resources in times of critical peak system demand.
- Expected applications -- all commercial and industrial general lighting applications that use linear T-8 lamps.



Energy Efficient Load Shedding Technology

Accomplishments

- Successful demonstration of the load shed capability.
- Life testing of dimming instant-start operated lamps indicates no negative effect.
- The low-cost power line carrier (PLC) receiver technology has been designed and tested.



Fully operational prototype has been demonstrated (prototype has not yet been incorporated into ballast case).



Energy Efficient Load Shedding Technology



- Energy
 - Ballast efficiency factor equal to instant-start ballasts.
- Dimming:
 - 33% power reduction and < 35% light output reduction.
 - Dimming rate: smooth ramp (from 3 to 120 seconds).
 - Always starts lamp at full power.
- Signaling:
 - Power line carrier (PLC) - presence of signal triggers and sustains load shed, absence of signal triggers normal full light output.
 - System coverage equals 10,000 ft² (approximately 100 ballasts) per PLC transmitter.



Energy Efficient Load Shedding Technology



- Economic analysis of demand charge rates and demand response programs has lead to a target end-use cost of \$9.00 per ballast.
- Simple payback is 2.5 to 3 years based on California utility demand rates.
- Utility involvement and incentives may be needed to support customer acceptance.
- LRC and major ballast manufacturer are now working to integrate technology directly into the ballast.



Energy Efficient Load Shedding Technology



Future Efforts

- Full scale demonstration planned for 2005 in an office building in Rye, NY.
- LRC and its partners to provide and install up to 200 load shed ballasts and necessary controllers.
- ConEdison & LRC to exercise system via signaling from outside building and with building's energy management system.
- Evaluation of demonstration results by LRC and manufacturing partners before furthering commercialization.



LED Exterior Fixtures

Product: *Exterior porch lighting systems that integrate high efficiency optics with solid state technology and lighting controls.*

- The California Lighting Technology Center (CLTC) has developed a hybrid LED/incandescent fixture with an integrated occupancy sensor.
- Incandescent used because of low first cost versus higher cost of CFLs; CFL option may be offered.
- Exceptional lighting optics and energy efficiency (LED - 5 watt packages versus 60 watt incandescent lamps).
- Expected applications -- commercial and residential entry way and walkway lighting.



LED Exterior Fixtures

How it works

- Amber LED array runs continuously during the night.
- Occupancy sensor turns on the incandescent lamp when motion is detected.
- After a few minutes, the occupancy sensor turns the incandescent off.
- There is always light in the coverage area.





LED Exterior Fixtures

■ Energy use:

- LED array uses ~5 watts of energy per nighttime hour. Assuming only 1 hour of burn per night, the incandescent lamp consumes 75 watts. Total is 125 watts over 10 hours.

■ Maintenance:

- With 50,000 hours of life, the LEDs should last 13 years. With less use each night, the incandescent lamp life is extended.

■ Brightness:

- LEDs provide sufficient light to identify the surroundings. Incandescent lamp provides expected outdoor light levels.





LED Exterior Fixtures

- Next steps include
 - Perform field demonstrations by the end of 2004.
 - SMUD is the utility partner for demos.
 - Collect consumer input and field data.

- More design concepts are under development
 - Manufacturing partners are Shaper Lighting, The Watt Stopper, and Lithonia.
 - LED only entry fixtures and LED/PAR lamp security lights.
 - Prototypes in late 2004 or early 2005.



More PIER LRP Technologies



■ Smart bathroom fixture

- LEDs and integrated occupancy sensor.
- Provides low level lighting when area is unoccupied.
- Applications include large scale hotels and assisted living facilities.
- Reduces energy use yet provides ability to see at night.
- Battery backup for emergencies.





More PIER LRP Technologies



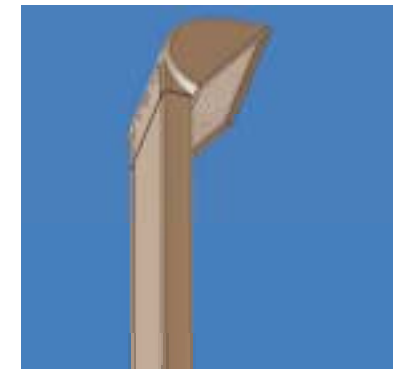
■ Downlighting system for retrofit and new construction spaces

- Energy efficient CFL system provides quality light.
- Plug-n-play design easy to install.
- Commercial and residential applications.
- Builder partnerships established through SMUD.



■ Low glare outdoor metal halide wall sconce

- Better coverage area with improved optics.
- Increased security and energy efficiency.
- Reduced night sky pollution.



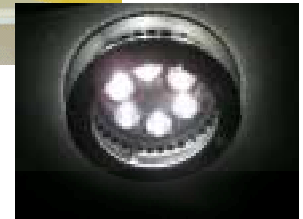
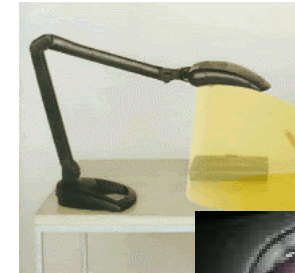


More PIER LRP Technologies



- LED task lighting and low profile lighting for elevators

- Long lamp life and reduced energy use.
- Excellent durability and highly controllable.



- Portable fixture for single or multi-office spaces

- Integrates task/ambient lights with occupancy sensor.
- Delivers light where and when needed.
- Maximizes occupant comfort and energy savings (~ 40 to 60% savings)





Lighting Research Program



Information on the LRP products is available
on the following web sites:

www.energy.ca.gov/pier/buildings/projects/500-01-041-0.html

www.archenergy.com/lrp