



Integrated Classroom Lighting System: Light's Great, Less Billing

PIER Buildings Program

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The Problem

Typical classroom lighting is expensive to operate and does not meet the functional needs of teachers or students. The modern classroom requires a range of lighting scenarios, from full lighting for traditional teaching to various levels of dimming and light distribution for audiovisual (A/V) presentations and other activities. Most existing systems don't have the flexibility to provide high-quality lighting in this varying environment.

The Solution

The Integrated Classroom Lighting System (ICLS) features efficient fixtures, high-efficiency fluorescent light sources, and user-friendly controls. The system gives school facility designers and specifiers a way to cut energy use while providing light when and where it is needed (**Table 1**). An innovative teacher control center lets instructors adjust the lights from the front of the classroom to meet changing activity needs (**Figure 1**). Finelite Inc. of Union City, California, offers the system as a commercial product.

Features and Benefits

The ICLS combines innovative fixture design, user-friendly controls, and plug-and-play wiring to achieve efficient, cost-effective, high-quality classroom lighting.

Indirect and direct lighting. The ICLS sends light upward and

Table 1: Integrated Classroom Lighting System specifications

The basic ICLS specs are for a nominal classroom of 30 feet by 32 feet. Adjusting the ballast factor for rooms of different sizes keeps the power density under 1 watt per square foot. A typical system might feature two rows of lamps spaced 14 feet apart.

Element	Feature
Lamps	Super T8 (3,500 K; 3,100 initial lm), 3/fixture
Ballasts	Instant-start, BF 0.88
Power density (W/f ²)	0.80–0.95 (0.35 in A/V mode)
Desktop light levels (fc)	30–50
Fixtures	Indirect/direct; 14-ft centers (2-row system)
Controls	Teacher control near teacher's desk; row control near door
Occupancy control	Factory set for 10-min delay; uses ultrasonic and infrared
Dimming option	For downlight; to 5% of full output
Daylight control option	Multiple options are available for daylight harvesting.

Notes: A/V = audiovisual; BF = ballast factor;
f² = square foot; fc = foot-candle;
ft = feet; K = kelvin; lm = lumens;
min = minute; W = watts.

Figure 1: New lighting for Barrett Ranch School

The ICLS provides high-quality illumination at the Barrett Ranch School in Antelope, California. Teachers can easily change between general and audiovisual lighting levels and also control a whiteboard light.



downward as needed, minimizing glare and creating an inviting environment for work or study. It also offers an installation cost advantage, requiring fewer power feeds and less mounting hardware than traditional classroom lighting—only one power connection is needed for a 24-foot row of fixtures.

Plug-and-play wiring. The ICLS wiring requirements simplify the contractor's job. Running Class 2–rated, Category 5–style wiring to the teacher control center, occupancy sensor, and any daylight sensors is all that's needed.

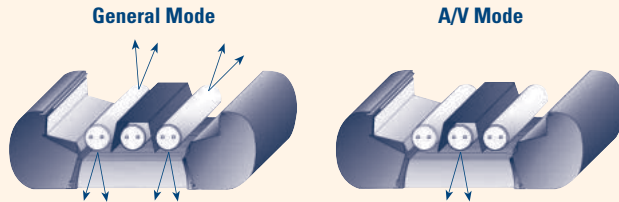
Quiet-time switch. To ensure that the occupancy sensors do not turn off the lights when, for example, students are quietly taking a test or the teacher is grading papers at night, a "quiet-time" switch allows teachers to bypass the occupancy sensor for 60 minutes.

Surfaces with high reflectivity. A new, 96 percent reflective material developed specifically for ICLS fixtures contributes to the system's high efficiency. Standard fixtures use 86 percent reflective white paint.

Flexible, easy-to-use controls. The teacher control center provides lots of options. For general lighting, the teacher selects the "general" mode, in which two lamps uniformly illuminate the walls and ceiling while fully lighting key areas such as the teacher's face and students' desks (**Figure 2**, next page). For A/V presentations or when students are reading, the teacher can switch to the "A/V" mode that uses a single lamp and focuses the light downward, reducing wall and ceiling brightness. An interlock ensures that all three lamps are never on at the same time. In practice, teachers are using the control flexibility to help direct students' attention and settle them down after recess.

Figure 2: Illumination options

The ICLS uses two lamps to provide full classroom lighting and a single lamp to provide more moderate light for classroom activities such as audiovisual presentations.



Single point of contact. The ICLS is available as an integrated package from Finelite Inc., which is responsible for system layout, pricing, training, commissioning, and warranty services.

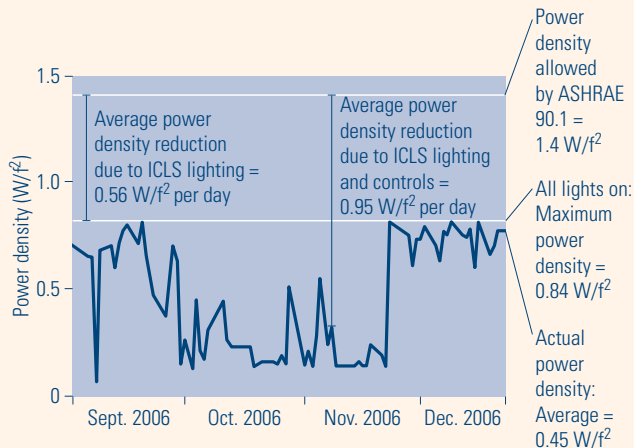
Whiteboard version. A new version of the product provides more light on the classroom whiteboard for improved contrast and readability. The design also reduces ambient light requirements so that a ballast with a low ballast factor can be used. Power densities are 0.8 watts per square foot in full mode and 0.35 W/ft² in A/V mode.

Cost-effective. The base system costs less to install than a conventional system with parabolic troffers and is projected to cut energy use by about 35 to 50 percent, offering an immediate payback. Field installations in 19 California classrooms and recent monitoring in 28 classrooms in New York (Figure 3) have confirmed these savings.

Figure 3: Controls boost savings

The ICLS produces savings in two ways: through a lower installed power density; and with controls that reduce power draw based on occupancy, daylight, and activities in the room.

Energy savings of 38 percent were measured in New York classrooms.



Notes: ASHRAE = American Society of Heating, Refrigerating, and Air-Conditioning Engineers; ft² = square foot; ICLS = integrated classroom lighting system; W = watt.

Applications

The ICLS is cost-effective in new school construction, building renovations, and retrofit projects. It has been proven effective in standard classrooms, larger conference rooms, and low-ceiling modular classrooms. Demonstrations funded by the New York State Energy Research and Development Authority (NYSERDA) and the California Energy Commission showed an average lighting power density of about 0.6 watts per square foot and very positive user acceptance.

California Codes and Standards

The ICLS can be used to meet the current Title 24 requirements, which call for lighting to draw no more than 1.2 watts per square foot. Two leading sustainability programs, the Collaborative for High Performance Schools (CHPS) and LEED for Schools, have also used the ICLS specifications as a guideline for their school lighting criteria.

What's Next

A retrofit-specific version of the ICLS is currently in development in a collaborative effort between Finelite Inc. and the California Lighting Technology Center (CLTC), funded by the PIER program. The first field tests and demonstrations are expected in 2008.

Collaborators

The organizations involved in this project include Finelite Inc., Watt Stopper, NYSERDA, and the California Lighting Technology Center.

For More Information

For more information on this project, please contact the California Energy Commission researcher listed below. To view Technical Briefs on other topics, visit www.esource.com/public/products/cec_form.asp.

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About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) Program. PIER supports public interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

Arnold Schwarzenegger, Governor

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