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

The Problem

Typical classroom lighting does not meet the functional needs of teachers or students and is expensive to operate. The modern classroom requires a range of lighting scenarios, from full lighting for traditional classroom teaching to various levels of dimming and light distribution for audiovisual (A/V) presentations and other activities. Existing classroom lighting systems don't have enough flexibility to provide quality lighting in this evolving environment, but there are energy-efficient and far more cost-effective alternatives.

The Solution

The Integrated Classroom Lighting System (ICLS) is made up of efficient light fixtures, high-efficiency fluorescent light sources, and user-friendly controls. The system provides school facility designers and specifiers with lighting that cuts energy use in half while providing light when and where it is needed (see **Table 1**). Finelite Inc. now offers the system as a commercial product. An innovative Teacher Control Center allows instructors to adjust the lighting from the front of the classroom to meet changing activity needs. (See **Figure 1**.)

Features and Benefits

The ICLS combines innovative fixture design and user-friendly controls to fulfill its mission of providing efficient, high-quality classroom lighting.

Table 1: Integrated Classroom Lighting System specifications

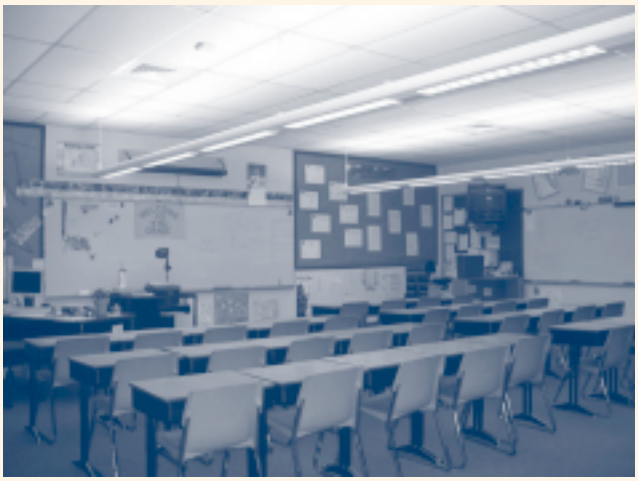
The basic ICLS specs are for a nominal classroom of 30 by 32 feet. Adjusting the ballast factor for rooms of different sizes keeps the power density under 1 watt per square foot. A typical system might feature two rows of lamps spaced 14 feet apart. You might need three rows of lamps spaced 12 feet apart for rooms with little or no available daylight.

	Features
Lamps	Super T8s (3,500 K and 3,050 initial lumens), 3 per fixture
Ballasts	Instant start, ballast factor 1.18 (0.77 if a third row is added)
Desktop light levels (foot candles)	30 to 50
Fixtures	Indirect/direct; 14-foot centers (two-row system)
Controls	Teacher control near teacher's desk; row control near door
Occupancy control	Factory-set for 12- to 30-minute delay
Dimming option	For downlights; to 5 percent of full output
Daylight control option	Turns off one row of lights in response to daylight

Note: K = degrees kelvin.

Figure 1: New lighting for Heritage Oak School

Nearly all of the teachers at the Heritage Oak School preferred the Integrated Classroom Lighting System to the old parabolic troffers. The new system didn't just perform better—it also cut energy use in half.



Indirect/direct lighting. The ICLS sends light upwards and downwards, minimizing glare and creating a soft, inviting environment for work or study. It also provides an installation cost advantage over parabolic lighting—only one power connection is required for an entire 24-foot row of fixtures, while parabolic fixtures require more power feeds and mounting hardware.

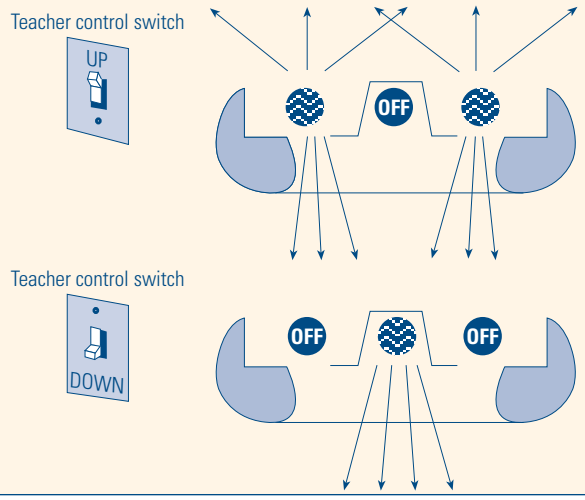
Surfaces with high reflectivity. A new 96 percent reflective material developed specifically for ICLS fixtures contributes to the system's high efficiency. Standard fixtures use 86 percent reflective white paint.

Flexible, easy-to-use controls. For general classroom lighting, the teacher selects the "up-light" mode, in which two lamps provide uniform illumination of walls and ceiling while fully illuminating key areas such as the teacher's face and students' desks (**Figure 2**). For A/V presentations or when students are reading, the teacher can flick a switch to select the "downlight" mode that uses a single lamp and focuses the light downward, reducing wall and ceiling brightness.

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

Figure 2: Illumination options

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



All these features add up to a system that is energy-efficient, easy to maintain, and provides a rapid payback (see **Table 2**). The base system costs less to install than a conventional lighting system with parabolic troffers and is projected to cut energy use by about 50 percent, providing an immediate payback. Field installations in 19 California classrooms have confirmed these savings.

Table 2: ICLS offers immediate payback

The basic Integrated Classroom Lighting System with occupancy sensors offers a lower power density than a conventional parabolic direct-lighting system and new installations cost less, so the payback is immediate. Other options add costs but can cut power usage even more. The base system features two rows of fixtures and occupancy sensors. Adding a third row of fixtures increases the uniformity of light, but it also increases the payback period to 7 to 10 years.

Alternative	Installed cost	Difference	Power density (watts/ft^2)[a]	Payback
Standard system, 15 parabolics	$2,745	NA	1.35	NA
Base ICLS system (2 rows per room)	$2,600	–$145	0.93	Immediate
Daylight switching (each row)	Add $175	$30	0.47	3-6 months
Dimming (2 rows, 1 lamp)	Add $500	$355	0.20	2-3 years
3 rows per room	Add $1,100	$955	0.95	7-10 years

Notes: NA = not applicable; ft^2 = square feet.

a. Power density is effective power density, accounting for action of energy saving mechanisms in the course of a 6.5-hour operating day.

Applications

The ICLS can be applied directly to new school construction. But most of the energy-savings potential in California (and nationwide) comes from upgrading existing school lighting. For that reason, a remodel kit has been developed to make it easy to install the ICLS in older classrooms where the electrical system might not be readily accessible. The retrofit kit has been successfully used in a field installation at the Dudley School in Roseville, California, where glue-on ceiling tiles and limited access to electrical circuits made installation difficult.

California Codes and Standards

The ICLS system can be used to meet 2005 Title 24 requirements calling for lighting to draw no more than 1.2 watts per square foot.

What's Next

In the summer of 2004, the project team is optimizing a product for classrooms designed to work with daylighting. The team will also complete analysis of energy consumption and usage patterns in each of the 19 classrooms where the ICLS has been installed for the 2003–2004 school year. In addition, efforts are under way to have the California State Architect pre-approve the system for new and remodeled classrooms, and to inform school districts and prominent school architects about system benefits.

Collaborators

The organizations involved in this project include Finelite Inc. and Watt Stopper.

For More Information

Reports documenting this project and providing more details may be downloaded from the Web at www.archenergy.com/lrp/products/classroom.htm.

Contacts

Finelite Inc., Terry Clark, tclark@finelite.com, 510-441-1100, www.finelite.com

California Energy Commission, Nancy Jenkins, njenkins@energy.state.ca.us, or visit www.energy.ca.gov/pier/buildings

About PIER

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