



CLASSROOM LIGHTING

Demonstration and Evaluation of Lighting Technologies and Applications ▲ Lighting Case Studies

From grade schools to universities, the classroom environment is changing, with teachers increasingly using audio-visual projections to communicate with their students. Traditional instructional technology (chalkboards) required only one mode of general lighting. New instructional technologies require a second lighting mode — darker in the front of the room, and brighter in the student seating areas.

The Integrated Classroom Lighting System (ICLS) provides these two lighting modes with controls technology to facilitate switching between modes.¹

Application profile

Seven schools in New York State participated in a demonstration of the ICLS.² At each of the seven schools, DELTA evaluated the lighting before and after retrofit of the ICLS in four classrooms.³

Lighting objectives

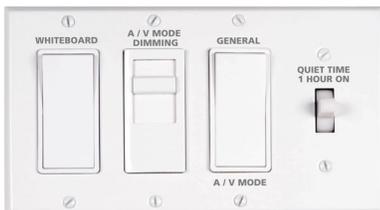
- Provide lighting for both audiovisual presentations and general teaching conditions
- Provide task lighting on the main teaching board
- Integrate the lighting and controls technologies into an easy-to-use system for teachers

Lighting system

The ICLS typically includes two rows of pendant direct/indirect luminaires and a separate wallwash luminaire for the main teaching board. The teacher control center (TCC) allows the teacher to change the lighting distribution from General mode (both uplight and downlight) to A/V mode (downlight only). The A/V mode, intended to be used during audio-visual

presentations, includes an adjustable dimmer (optional). The Whiteboard switch allows the teacher to direct light towards the main teaching board. A Quiet Time switch overrides the occupancy sensor for one hour,

keeping the lighting on during long periods of occupied non-movement such as standardized testing. The TCC is located near the main teaching board. Other controls in the ICLS include a hybrid ultrasonic/infrared occupancy sensor and a master on/off switch at the door.



Teacher control center



General mode (uplight and downlight) and Whiteboard light



Ballston Spa MS before and after ICLS retrofit



A/V mode (downlight only)

¹ See case study, "Integrated Energy Lighting System," accessed October 16, 2007 at http://www.archenergy.com/lrp/products/brochures/deliverable_6.2.5_CaseStudy_4.5.pdf.

² Middle and high schools included: Ballston Spa Middle School, Hunter College Campus (High) School, Ray Middle School, and Scarsdale High School. Universities included: New School, Rensselaer Polytechnic Institute, and Syracuse University.

³ Detailed results of the full lighting demonstration are available from the Lighting Research Center.

Teacher survey

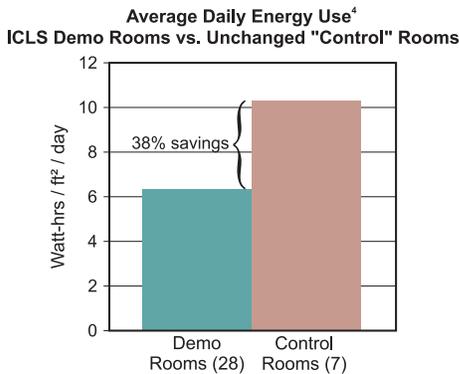
The teachers at the middle and high schools rated the ICLS favorably. They use the General mode for many teaching functions and the A/V mode for the intended presentations. They enjoy the added light for the main teaching board, as well as the dimmer for the A/V mode. However, they did not rate the Quiet Time mode as particularly helpful. Overall, these teachers considered the ICLS better than their previous lighting system. Feedback from university instructors was more mixed, perhaps due to less familiarity with the ICLS' features.

Installation and maintenance feedback

Electricians at the schools in this study characterized the ICLS as "easy to install." After one year of operation, there have been no major complaints about maintenance of the ICLS at the demonstration sites.

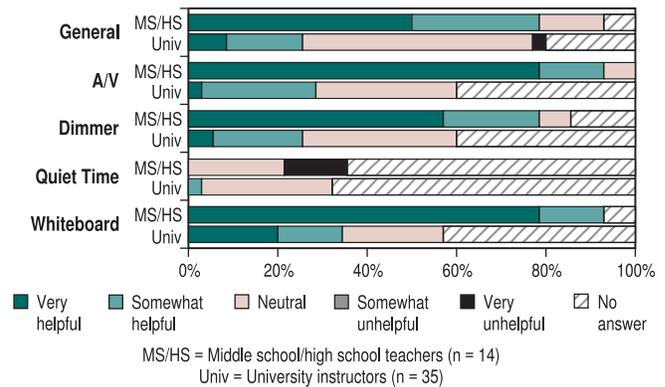
Energy savings

DELTA researchers performed a spot check of energy use with and without retrofit with ICLS.⁴ Six schools reduced their lighting power density relative to previous lighting. However, illuminances and lighting power density at one school were slightly higher after retrofit; this school did not show energy savings. Energy savings from all seven schools together averaged 38%. The graph (right) shows projected savings compared to other power densities.



⁴ Room sizes, lighting configurations, and lighting use patterns varied across the schools. Researchers sampled lighting use in 28 ICLS rooms and 7 control rooms over a typical week in the fall, winter, and spring. To compare across all schools in equivalent terms, energy use data (in watt-hours) were averaged over the 15 sampled days and over the square footage of the rooms.

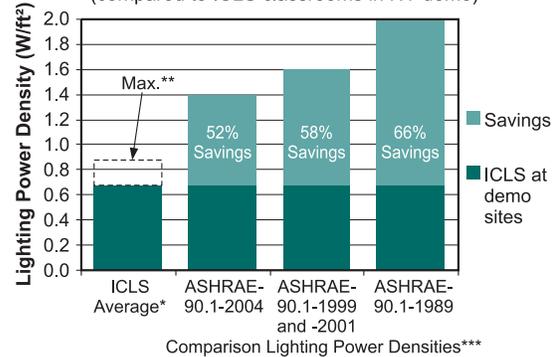
"Do you find _____ mode helpful in your teaching?"



"It is much better than the lighting in my former room. [There is] less glare and the students really like them now!"
— Middle school teacher

"It really couldn't have been any easier." — Electrician

Lighting Power Densities and Projected Savings (compared to ICLS classrooms in NY demo)



* Average based on observed patterns of ICLS mode use at all demo classrooms.
 ** Maximum power density, averaged across all the schools (0.88 W/ft²); this includes both General and Whiteboard light modes.
 *** Lighting power density limits for classrooms (space-by-space method) as outlined in ASHRAE-IESNA 90.1 standards. At press time, New York State Energy Conservation Construction Code references ASHRAE-IESNA 90.1-2001.
 Note: More information about lighting for classrooms is available from New York Collaborative for High Performance Schools (NY-CHPS) and Leadership in Energy and Environmental Design (LEED) for Schools.

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Classroom Lighting

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Field Test DELTA evaluates new energy-efficient lighting products to independently verify field performance claims and to suggest improvements. A primary goal of the Field Test DELTA program is to facilitate rapid market acceptance of innovative energy-efficient technologies.

Lighting Research Center

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