ENCRYPTION SOLUTIONS
for the Classroom

INTEGRATED CLASSROOM LIGHTING

“"The model classroom at CTAC provides a hands-on learning environment for understanding the benefits of integrated lighting systems.”

Gregg D. Ander, FAIA
Chief Architect
Southern California Edison

INTEGRATE DAYLIGHT WITH ADVANCED ELECTRIC LIGHTING SYSTEMS

Southern California Edison (SCE) demonstrates the most advanced possible classroom integrated lighting systems featuring optimum daylight, uniform illuminance distribution, and energy efficiency at its Customer Technology Application Center (CTAC) in Irwindale.

The benefits of daylighting in the classroom are well documented. Studies show that a naturally lit environment boosts student test scores and attendance while substantially contributing to energy savings. High performance classrooms must carefully integrate daylighting apertures with electric lighting and lighting controls.
The high-efficiency classroom lighting at CTAC exhibits the integration of daylighting and energy-efficient electric lighting. The classroom mimics a typical Southern California classroom, with its 960-square-foot size, rectangular shape, and 11-foot ceiling. For the most effective daylighting, the classroom is oriented with the window wall facing south (or north) and skylights (or light pipes) lighting the surface opposite the window wall. Skylights or light pipes above the north interior wall balance the daylight coming from the south window wall. To avoid glare, the teaching wall is adjacent to the daylit wall on the east wall and the classroom entry is opposite the teaching wall.

**AMBIENT LIGHTING SYSTEMS**

**Lighting Alternatives**

The CTAC classroom demonstrates two energy-efficient electric lighting systems: Super T-8 and T-5 High Output (HO)

- Super T-8 with an open-loop photo sensor which dims lighting in connection with available daylight.
  - 20-foot semi-indirect luminaires are suspended in two rows of ten lamps each.
  - Each luminaire employs two high-lumen T-8 lamps, powered from high-ballast-factor electronic ballasts for energy efficiency and longer life.

  - Whiteboard task light is a 12-foot-long linear wall washer with three Super T-8 lamps.
  - Stepped lighting provides an on/off feature, depending on the availability of daylight.

For the most effective, balanced daylighting, orient classroom to use a south or north window wall with skylights washing the opposite wall.
• T-5 HO with a closed-loop photo sensor for dimming capability:
  o Two 20-foot direct/indirect luminaires are suspended in two rows of five lamps each.
  o Each luminaire employs one high-lumen T-5 HO lamp, powered from high-ballast-factor electronic dimming ballast.
  o The whiteboard task light is a 12-foot-long linear wall washer with three Super T-8 lamps. (T-5 HO is also available.)

LIGHTING CONTROLS

Lighting controls are essential for maximizing energy savings and flexibility. The CTAC classroom uses two types of automatic controls—occupancy sensors that turn lights off when rooms are unoccupied for more than 15 minutes and photo sensors that dim or turn off lamps when daylight is abundant—as well as manual controls.

• Dual technology occupancy sensors
  o Combine passive infrared triggers (targeting body heat in motion) and ultrasonic triggers (targeting changes in the reflection patterns of ultrasonic signals).
  o Help eliminate false activations in rooms with strong airflow.

• Photo sensors
  o Closed-loop photo sensors “see” reflected daylight and reflected luminaire lighting.
  o Open-loop photo sensors “see” only primary daylight.

• Manual controls
  o Adjacent to classroom door: Two switches, labeled “Row 1” and “Row 2,” allow the teacher to energize the ambient lighting upon entry.
  o Teacher Control Center: Houses the whiteboard luminaire on/off switch, manual overrides for A/V mode, and a one-hour, quiet-time override switch.

DAYLIGHTING CONTROLS AND DETAILS

The view and daylight windows in the CTAC classroom provide abundant light, but without adequate daylight controls, sunlight produces glare and excessive heat gain. To counter these negative effects, the CTAC classroom uses fenestration controls, including exterior light shelves, louvers and interior roller blinds.

• Upper Daylighting Windows
  o Dual pane, low-E glazing with 68 percent visible light transmission (VLT) and .4 solar heat gain coefficient (SHGC).
  o Two-inch window reflective blinds for glare control.

• Lower View Windows
  o Dual pane, low-E glazing with 46 percent VLT and .35 SHGC.
  o Microfiber shades with 14 percent VLT for access to views while mitigating glare and heat gain, providing .056 percent VLT total.

The shading device and louvers control heat gain, while the light shelf increases daylight in the classroom.

LIGHT SHELVES

Light shelves reflect sunlight onto the ceiling and into the classroom. They facilitate balanced daylight by redirecting sunlight from the upper windows and shading lower windows to reduce glare.
CONCLUSION

The electric lighting and daylighting demonstrated at CTAC show that typical Southern California classrooms can—with careful planning and execution—become high performance classrooms by integrating daylighting and electric lighting systems and controls. This project demonstrates the following key recommendations:

- To improve daylight illumination, duration, and uniformity: Install continuous, upper daylight windows with interior light shelves.

- To mitigate hot spots that may be produced by light pipes: Install a continuous skylight illuminating the surface of the opposite wall.

- To improve daylight quantity and quality by balancing illumination: Install a continuous light reflector in the form of a light shelf or a skylight reflector.

Skylight reflector brightens the ceiling plane.

ADDITIONAL RESOURCES

For more resources about how your school or school district can reap the benefits of a high performance classroom, visit these websites:

- SCE Classroom Lighting Guide: www.sce.com/classroomlighting
- Bright Schools: www.energy.ca.gov/efficiency/brightschoo/index.html
- Collaborative for High Performance Schools (CHPS): www.chps.net
- The Daylighting Collaborative: www.ecw.org
- Energy Design Resources: www.energydesignresources.com
- EPA Energy Star Schools: www.energystar.gov
- Energy Smart Schools, a Rebuild America Campaign: www.eren.doe.gov/energysmartschools/
- Rebuild America: www.rebuild.org/index.asp
- Savings By Design: www.savingsbydesign.com

For more information, contact your Southern California Account Executive.

This integrated classroom lighting guide is provided for your general information and is not intended as a recommendation or endorsement of any particular product or company. The program is funded by California utility customers and administered by Southern California Edison, under the auspices of the California Public Utilities Commission.