



DAYLIGHTING *initiative*

Design tools and information from PG&E

Industrial Application

Retail Application

Office Application

School Application

Museum Application

Restaurant Application





PG&E'S DAYLIGHTING INITIATIVE

PG&E's daylighting initiative has two goals: to raise awareness of good daylighting practice within the design community and to improve the practice of daylighting design. This case study is one of a dozen case studies undertaken within the initiative. Together, they document a wide range of successful technical solutions demonstrated across a number of different commercial applications.

The Daylighting Initiative includes projects that will make better design tools available to the daylighting design community. The Desktop Radiance project, a collaborative effort of Lawrence Berkeley National Laboratory and PG&E, is bringing the powerful Radiance lighting simulation capabilities into the practical world of architectural CAD software. The Daylighting Initiative also includes a series of workshops and seminars at the Pacific Energy Center in San Francisco. For more information, visit the project's web site at www.pge.com/pec/daylight.

DAYLIGHTING AT CALIFORNIA STATE AUTOMOBILE ASSOCIATION

The four-year-old California State Automobile Association (CSAA) district office in Antioch, California, has features in its successful daylighting design that are being considered for use in the company's offices nationwide. The office space at CSAA in Antioch offers a spacious interior with high ceilings, advanced skylights, high-performance glazing, perforated blinds, and automated lighting controls that provide a bright and comfortable space.

DAYLIGHTING FEATURES OF CSAA, ANTIOCH

The original two-story design was changed to a single-story layout that uses daylight from skylights and perimeter windows as a primary lighting source. The lighting system was redesigned using T-8 and compact fluorescent technology to provide the required illuminance of 30–40 footcandles (fc) in the main work areas and 50–60 fc from task lights at desks. In this way, the design team developed a lighting system that maximized energy efficiency and provided a good working environment in a cost-effective manner. This was done through the use of physical daylighting models along with DOE2 energy simulation analysis.

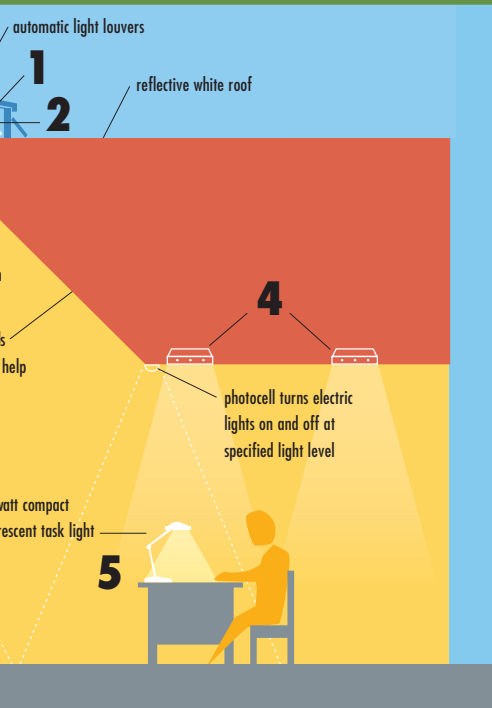
DOE2 is an hour-by-hour thermal and energy simulation program that dynamically models a building's energy consumption for a full year.

1 SKYLIGHTS In the center of the building, the ceiling height is vaulted to 15 feet while the perimeter ceiling is at 10 feet. A higher ceiling allows a uniform daylighting distribution over the workstations. Twenty-nine

triple-pane, acrylic, low-glare skylights, spaced approximately 20 feet apart, equivalent to 3.7 percent of the floor area, distribute daylight throughout the office. Skylight wells are played at 45-degree angles to provide optimal light quality and distribution. Skylights and high ceilings also enhance the architectural character of the building and give a feeling of spaciousness.

2 LOUVERS Louvers installed at the top of skylight wells are controlled by photocells. These daylight-sensitive controls open and close louvers to continuously modulate the amount of light entering the building and maintain illumination at glare-free levels (~ 70 fc).

3 BAROMETRIC EXHAUST VENTS Barometric exhaust vents in each skylight provide building pressurization control and solar heat exhaust from skylight wells to reduce heat gain throughout the building.



“There’s a bright, airy, and spacious feel to the space,” says Office Supervisor Janet Burns. “It’s a real morale booster for employees.”

4 DIMMABLE ELECTRONIC BALLASTS

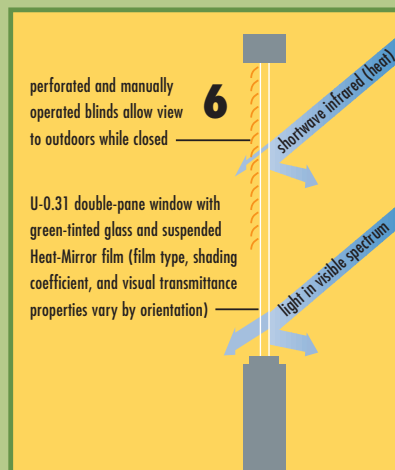
Dimmable electronic ballasts are incorporated in highly efficient T-8 fluorescent fixtures to allow continuous dimming control and maintain interior light levels. Continuous dimming reduces light output from 100 percent to 20 percent and power input from 100 percent to 40 percent as the daylight increases. When the daylight illumination exceeds 60 fc, the electric lighting shuts off. Combination light and motion sensors also activate the lighting system when a space is occupied. A second photocell turns on lights when skylights provide less than 30 fc. Total installed lighting power is about 10.3 kW which is equal to 0.66 W/ft². Eighty-six percent of the building’s interior electric lighting is under daylight control.

5 WORKSTATION LIGHTING

Workstations requiring enhanced lighting levels are equipped with either swing arm-mounted or undercabinet-mounted task lights. Both types of task lights use compact fluorescent lamps with electronic ballasts.

6 GLAZING AND WINDOW BLINDS

Low U-value, spectrally selective windows reduce thermal energy transfer and maintain comfortable environmental and visual conditions. To achieve optimal performance, light transmittance and shading coefficient characteristics were selected for each window based on the building’s orientation. Fixed-pitch perforated window blinds provide glare control without decreasing visibility.



CSAA, ANTIOCH—AN ACT² DEMONSTRATION SITE

California State Automobile Association’s district office in Antioch, California, is one of nine PG&E ACT²—Advanced Customer Technology Test For Maximum Energy Efficiency—demonstration sites that have tested energy efficiency and cost-effective packages of advanced technologies. The Antioch building includes energy-saving technologies and design features that reduced total energy consumption by 64 percent. (See ACT² CSAA Commercial Site Impact Evaluation Report at the following web site: www.pge.com/pec/act2.)



The daylighting system at CSAA includes several important features targeting energy efficiency, cost-effectiveness, and light quality.

RESULTS

The daylighting features incorporated into the 15,000 sq. ft. office building reduced the need for electrical lighting during normal operating hours which, in turn, reduced the cooling requirements and allowed the building designers to downsize the heating-ventilation-air-conditioning (HVAC) system. Extensive monitoring of this building demonstrated that annual lighting energy (kWh) consumption was reduced by 32 percent. In addition, the daylighting features saved dollars by reducing kW demand and HVAC equipment costs.

Employees have reacted favorably to their office space. Here are some comments from recent employee surveys:

"I love the space!"

"I feel the daylight is easier on the eyes than electric light."

"I get used to not turning on or off a light switch...which means when I get home I expect my lights to turn on automatically!"

"The atmosphere created by the light is calming and easy to work with."

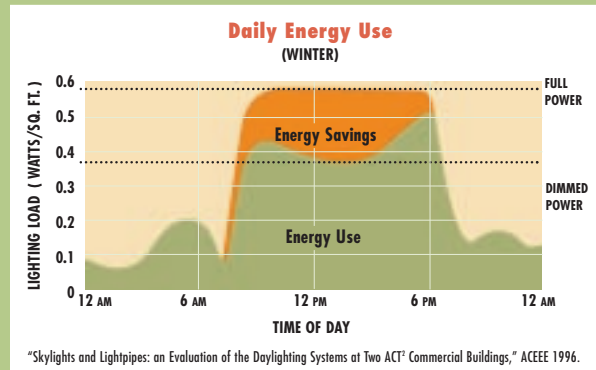
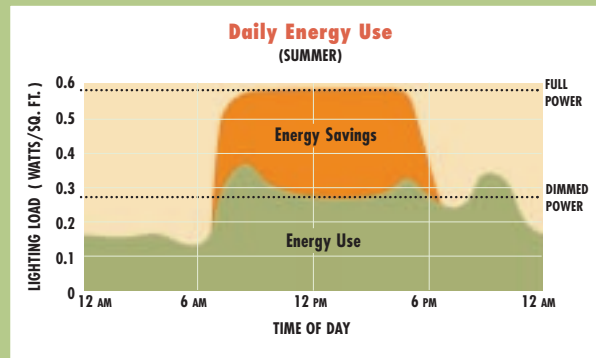
"Customers comment on the lighting every day. They find it very pleasant and pleasing to the eyes."

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"Skylights and Lightpipes: an Evaluation of the Daylighting Systems at Two ACT Commercial Buildings," ACEEE 1996.

The use of skylights, louvers, dimmable electronic ballasts, glazing, and window blinds create a year-round lighting energy consumption (kWh) savings of 32 percent.

RESOURCES

PG&E does not endorse any particular products or services from any specific manufacturer or service provider. High efficiency products and services similar to those used in this project are available from multiple suppliers. For informational purposes, PG&E notes that the following companies provided equipment or services to the project:

Architect: Brian Congleton, Architect AIA, Carmel, California
831-626-1928

Daylighting Design: Eley & Associates, San Francisco, California
www.eley.com — 415-957-1977

Dimmable Ballasts: Advance Transformer Co., Rosemont, Illinois
www.advancetransformer.com — 1-800-372-3331

Lighting Designers: Flack + Kurtz Consulting Engineers,
San Francisco, California/www.fk.com — 415-398-3833

Skylights & Automated Louvers: Sunoptics Prismatic Skylights
www.sunoptics.com — 1-800-289-4700

Photo & Motion Sensors: Sensor Switch Inc., Sacramento, California
www.sensorswitchinc.com — 1-800-338-7633

Window Films for Spectrally Selective Glazing: Southwall Technologies,
Palo Alto, California/www.southwall.com — 1-800-365-8794

ADDITIONAL CONTACT INFORMATION

Pacific Energy Center, San Francisco, California
www.pge.com/pec/daylight & www.pge.com/pec/act2 — 415-973-7206

California State Automobile Association, Contact: Neil Moy
www.csaa.com — 415-565-2076