



DAYLIGHTING *initiative*

Design tools and information from PG&E

Industrial Application

Restaurant Application

Retail Application



School Application

Museum Application

Office Application

A Cart Full Of

Costco gains huge energy savings with

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.

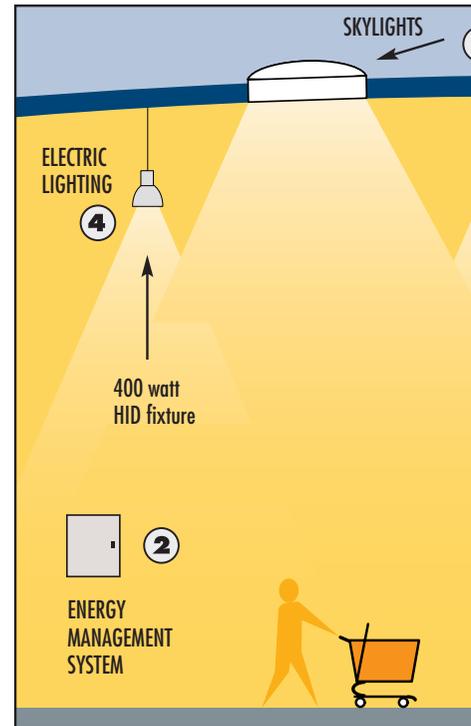
DAYLIGHTING AT COSTCO

Costco, a large chain of discount retail stores, began integrating skylights and daylighting controls in its stores in the late 1980s. Management wanted to increase light levels in its warehouse-style stores to provide an environment conducive to shopping. They also wanted to reduce operating costs and did so by integrating photocell-based daylighting controls with each store's Energy Management System (EMS), controlled remotely off-site. Today, skylights and automated daylighting controls are a standard feature in all new Costco stores and distribution centers.

DAYLIGHTING FEATURES

1 SKYLIGHTS

Rectangular 4-ft. x 8-ft. skylights cover approximately 4% of the roof area, evenly distributed over the shopping area below. The skylights are constructed of acrylic-clad fiberglass and are approximately 40% more efficient than standard medium-white acrylic-only skylights by maximizing natural light transmission with minimum heat gain. Visible light transmittance for each skylight is 72% with a 66% shading coefficient. Twenty-five-foot-high ceilings help diffuse the light throughout the space.

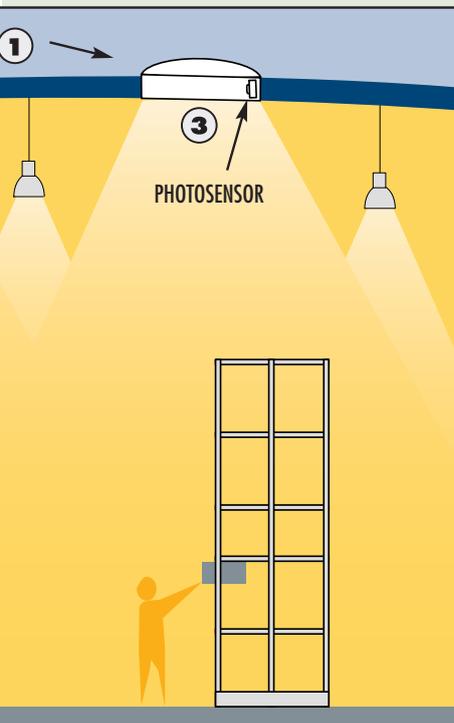


2 ENERGY MANAGEMENT SYSTEM

The original energy management system at Costco was designed to manage only the refrigeration and HVAC loads. Fortunately, there was room to integrate the custom-made daylighting controls into the centralized system when Costco began incorporating skylights into its new stores. Costco contracted with an EMS contractor to remotely monitor and control the settings at its 200+ stores. Store managers are able to override the daylighting controls locally if there is a perceived need for more light. If the utility bill seems high for a given month, the EMS team can remotely diagnose the cause by reviewing recent data trends.

Energy Savings

skylights and remote daylighting controls.



With an eye toward reducing operating costs and improving lighting conditions for customers, skylights and daylighting controls have become a building standard at Costco.

3 PHOTOSENSOR AND LIGHTING CONTROLS

A single photosensor, positioned in one of the skylights, signals the daylighting controller to turn the electric lights on or off. Electrical circuits are zoned so that light fixtures directly adjacent to a skylight are turned off as the daylight level in the store rises above the first set point. This zone circuit represents approximately one-third of the light fixtures in the store. The next third turns off when light levels rise above a second set point. The remaining third of the lights is always on during operating hours. Set points can be adjusted remotely, if needed, by the EMS contractor.

4 ELECTRIC LIGHTING

Metal halide luminaires—each 400 watts—provide a bright white light throughout the store. Metal halides, of the HID (High Intensity Discharge) type, require a warm-up time to achieve full brightness. This lamp feature requires special consideration when coupled with daylighting controls. The controller at Costco is programmed to allow the HID luminaires time to warm up before cycling off due to rapidly changing cloud cover. This helps to extend lamp and ballast life.

DAYLIGHTING AT COSTCO'S DISTRIBUTION CENTER

Projected Annual Savings: \$150,000

A new Costco distribution center in Mira Loma, California, incorporates the same daylighting strategy as Costco's retail stores. The new 653,000 sq.ft. dry goods distribution center was designed with 1,050 5-ft. x 6-ft. skylights covering 4.8% of the rooftop. Controlled in a manner similar to a retail store, the 1,640 metal halide luminaires operate in three daylight zones. Lower illumination levels are needed for a distribution center than a retail store. Additional savings are achieved in the distribution center by turning off all three zones when adequate daylight is available. Annual energy savings are projected at 2.5 kWh/sq.ft.-yr. or ~\$150,000.



Photo: Lisa Herschong, Herschong Mahone Group

RESULTS

A typical new Costco store will install skylights on ~5% of its 150,000 sq.ft. rooftop. The daylighting controller, integrated with the EMS, maintains the interior illuminance at a minimum of 55–65 foot-candles in the store. Annual energy savings are projected at 1.5 kWh/sq.ft.-yr. or \$23,000.

The remote monitoring and control service established with Costco's Energy Management System (EMS) contractor has helped ensure that savings persist over time. With an eye toward reducing operating costs and improving lighting conditions for customers, skylighting and daylighting controls have become a building standard at Costco.

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RESOURCES

PG&E does not endorse 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:

Skylights:

Bristolite Skylights, Santa Ana, California
www.bristolite.com — 714-540-8966

Daylighting Controls:

Day Light Controls, Redmond, Washington
www.daylightcontrols.com — 425-883-0914
Contact: Dave Long

Energy Management System:

Roberts Trane, Redmond, Washington
425-643-4310

ADDITIONAL CONTACT INFORMATION

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

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