

Solatube International

Daylighting Facts & Figures

Building Energy Efficiency

Daylight and lighting controls provide commercial benefits

Electric lighting comprises almost 25% of the total electricity used in buildings in the United States (US-DOE 2006) and buildings comprise over 75% of the total electricity used nationwide (US-EIA 2008), thus pursuing ways to improve the performance of lighting control systems is a worthwhile endeavor.

Van Den Wymelenberg, K.G. (2013, November). Identification of Discomfort Glare Sources from Vertical Fenestration and Occupant Control Strategies. *Illuminating Engineering Society*. Retrieved from <http://www.ies.org> (white paper courtesy of the author).

Government cafeteria incorporates daylighting with tubular skylights

National Renewable Energy Laboratory's state-of-the-art cafeteria on the South Table Mountain campus in Golden, Colo., certified to the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Platinum-level rating, uses about 25% less energy than a cafeteria built to current commercial code. Energy efficiency features include daylighting, accompanied by tubular skylights, to help achieve uniform light distribution across the main dining area space to limit the use of electric lighting.

(2012). Campus Cafeteria Serves As Sustainable Model for Energy-Efficient Food Service. *National Renewable Energy Laboratory*. Retrieved from http://www.nrel.gov/sustainable_nrel/buildings_cafe.html

Daylighting contributes to 24% energy reduction in Los Angeles schools

The most recent K-12 project that our team has been involved in was the Los Angeles Unified School District's Robert F. Kennedy Community Schools. Incorporating high-efficiency equipment in the design of the central plant, thermal displacement in all classrooms and large occupant areas, and daylight harvesting controls allowed the entire complex to have 24% energy reduction versus the latest California energy codes.

(2012, March). School is in Session. *Consulting-Specifying Engineer*. Retrieved from <http://www.csemag.com/single-article/school-is-in-session/55de8f70a29977d4d9ab021c94d2476e.html>

Daylighting reduces as much as one-third of total building energy costs

Daylighting is the controlled admission of natural light—direct sunlight and diffuse skylight—into a building to reduce electric lighting and saving energy. By providing a direct link to the dynamic and perpetually evolving patterns of outdoor illumination, daylighting helps create a visually stimulating and productive environment for building occupants, while reducing as much as one-third of total building energy costs.

The benefits of a daylit building extend beyond simple energy savings. For example, by reducing the need for electric consumption for lighting and cooling, the use of daylight reduces greenhouse gases and slows fossil fuel depletion.

Ander, G. (2011, August; updated 2014, October). Daylighting. *Whole Building Design Guide*. Retrieved from <http://www.wbdg.org/resources/daylighting.php>

Integration of daylighting strategies can reduce total energy costs by up to 30%

Daylighting has the potential to provide significant cost savings. For example, using an estimated incremental first cost increase of \$0.50 to \$0.75 per square foot of occupied space for dimmable ballasts, fixtures, and controls, daylighting has been shown to save from \$0.05 to \$0.20 per square foot annually (1997).

Additionally, electric lighting accounts for 35% to 50% of the total electrical energy consumption in commercial buildings. By generating waste heat, lighting also adds to the loads imposed on a building's mechanical cooling equipment. The energy savings from reduced electric lighting through the use of daylighting strategies can directly reduce building cooling energy usage by an additional 10% to 20%. Consequently, for many institutional and commercial buildings, total energy costs can be reduced by as much as one-third through the optimal integration of daylighting strategies.

Ander, G. (2011, August). Daylighting. *Whole Building Design Guide*. Retrieved from <http://www.wbdg.org/resources/daylighting.php>

Lighting costs can be reduced by 20 to 80% through daylighting

More than a third of the energy used in the United States is consumed in buildings, and 25 to 40 % of that is used to run electric lights. In many cases, daylight could be used instead. "Depending on the building and how it's used, a good daylighting strategy can reduce the need for energy-consuming electric lighting by 20 to 80 %," said Professor Marilynne Andersen of the Department of Architecture.

Stauffer, N. (2007, May). Daylight Device Lightens Electricity Cost. *Massachusetts Institute of Technology News*. Retrieved from <http://newsroom.mit.edu/2007/techtalk51-26.pdf>

Daylighting provides energy savings and soft savings for building occupants

A good daylighting design can save up to 75% of the energy used for electric lighting in a building. The amount of daylight available, the occupancy pattern, and the control strategy can all affect energy savings. In addition, because significant daylight is often available during utility peak demand hours, a good daylighting design can reduce demand charges. Electric lights also generate significant heat in a building and by turning off or dimming the lights when not needed, 10 to 20% of the energy used to cool a building can be saved. On top of that, so-called soft savings attributable to increases in productivity and health of the building occupants can add to the hard savings, researchers say.

Kozlowski, D. (2006, April). Using Daylighting to Save on Energy Costs. *FacilitiesNet*. Retrieved from <http://www.facilitiesnet.com/energyefficiency/article/Harnessing-Daylight-For-Energy-Savings-Facilities-Management-Energy-Efficiency-Feature--4267#>

Annual U.S. lighting expenditures top \$60 billion

The U.S. spends about one quarter of its entire electricity budget on lighting, equating to approximately \$60 billion annually. According to the New Buildings Institute, lighting comprises an average of 37% of a typical commercial building's total energy consumption.

Mocherniak, T. (2006, May). Lighting Technologies Produce Energy Savings. *Energy & Power Management*. Retrieved from www.hightbeam.com/doc/1G1-146346289.html

Daylight harvesting offers opportunity to reduce energy consumption, costs

The United States Department of Energy estimates that U.S. commercial businesses use one-quarter of their total energy consumption for lighting. Daylighting and its associated systems, therefore, offer the opportunity to reduce energy consumption and costs.

Commercial buildings in the United States house more than 64 billion feet of lit floor space. Most of these buildings are lit by fluorescent lighting systems. Estimates show between 30% and 50% of the spaces in these buildings have access to daylight either through windows or skylights. The installation of technologies designed to take advantage of available daylight would be an appropriate energy-saving strategy that could potentially turn off millions of light fixtures for some portion of each day.

Leslie, R.P., R. Raghavan, O. Howlett, and C. Eaton. (2005). The Potential of Simplified Concepts for Daylight Harvesting. *Lighting Research and Technology*. Retrieved from <http://www.lrc.rpi.edu/programs/daylighting/pdf/simplifiedConcepts.pdf>

Building cooling load reduction among the benefits of daylighting

- The single largest operating cost of commercial buildings in the U.S. is lighting. Lighting systems represent one-third or more of the total electrical energy costs of a commercial building. They also introduce heat into the space and increase building cooling loads. Because lighting systems significantly impact a building's operating cost and energy performance, evaluate options for the lighting systems before considering strategies for a low-energy HVAC system. Also, take advantage of daylighting opportunities whenever possible.
- Lighting systems constitute 30% to 50% of the total annual electrical energy consumption in U.S. office buildings. In the Federal sector, lighting accounts for 25% of the total electricity consumed annually.
- A building designed to take advantage of daylighting will have electric lighting system controls that turn the electric lights off or dim them when sufficient daylighting is available. The electric lights operate only to maintain set lighting conditions that the daylighting cannot meet. Less waste heat from the electric lighting system is then introduced to the space, which in turn reduces the building's cooling loads.
- The solar heat gains from a good daylighting system can be less than half of the heat gains from the most efficient current electric lighting system technologies, to achieve equal lighting levels in a space.

(2003). Los Alamos National Laboratory Sustainable Design Guide. U.S. Department of Energy. Retrieved from <http://www.lanl.gov/orgs/eng/engstandards/esm/architectural/Sustainable.pdf>