

## Daylighting Basics

### *Daylighting and Energy Savings*

Good daylighting design saves energy in many ways. The obvious one is lighting energy, which can represent a major portion of the total energy consumed by many buildings. Electric lights emit more heat than the same amount of natural daylight, so during the warmer months the air conditioning system has to work harder and needs to be sized for the added load.

With daylight comes free heat, which can save energy during the cooler seasons. Some products used mainly for providing natural light can also significantly reduce the amount of heat lost when

substituted for more traditional products.

This daylighting fact sheet addresses key differences between fenestration products installed

primarily vertically (windows, doors, curtain walls and storefronts), and those installed primarily overhead (skylights, roof windows and tubular daylighting devices [TDD]) and their relation to daylighting and energy savings. The common set of terms used by daylighting professionals for



these two fenestration categories is **side-lighting and top-lighting** respectively. Generally, all fenestration products can be sources of quality daylight and passive solar energy; however, additional factors need to be considered when comparisons and/or choices between side





lighting and top-lighting products are being made.

The basis for the difference is quite simple; side-lighting products face the horizon and top-lighting products face the sky.

**Side-lighting** from windows and doors provides daylight and solar energy along the perimeter of a building.

Good daylighting design should consider these side-lighting characteristics:

- Most daylight is provided through ambient lighting from the sky. The amount of daylight available will vary throughout the day depending on the direction the fenestration is facing. External obstructions are likely to reduce the available daylight.
- Orientation (north, east, south, west) with respect to the sun's path is a critical factor.
- The need for shading to avoid excessive glare is

essential when the sun is low in the sky.

**Top-lighting** can provide daylight and solar energy throughout the interior of a low rise building, on the top floor of a building or in an atrium. It should complement side-lighting in any good daylighting design, where conditions permit:

- Daylight is available throughout the day from both ambient lighting from the sky and direct exposure to the sun, and is more consistent.
- Modern transparent and/or translucent glazing can be utilized to avoid glare, aid in capturing sunlight at low angles and diffuse light to wider areas of floor space.
- Shading accessories can be used on many product options to manage light levels when desired or necessary.
- Even on a cloudy day, top-lighting can provide three times more daylight than side-

lighting according to SkyCalc calculations.

Effective daylighting design results in a system that includes side-lighting and/or top-lighting, electric lighting controls (automated if possible) and a building explicitly designed to optimize the usefulness of daylight.

In applications where daylighting is the primary goal, factors which impact the efficient application of side-lighting and/or top-lighting include:

#### **Building Purpose**

Non-residential – In a retail building, for example, daylighting is typically focused on the public retail areas and not on the lesser-used areas for storage and offices. Top-lighting can provide daylighting into any interior floor space area, a critical advantage for large floor plans, whereas traditional side-lighting is limited to the perimeter of the building spaces.

# Daylighting and Energy Savings



**Residential** – Daylighting is most beneficial in common areas. Top-lighting is particularly useful further from the perimeter of the building.

**Building Features** Ceiling height, surface colors and textures, light shelves, room dividers and partitions all impact the usefulness of the daylight available to the space and should be considered in daylighting design.

**Building Siting/ Orientation** Optimizing exposure to the sun's path is critical to any daylighting system. Top-lighting has the advantage of obtaining the most exposure for longer periods of the day.

**Multi-story vs. Single-Story** Side-lighting is easily provided on all floors of a multi-story building. However, through proper building design and/or use of integral light wells or tubular daylight devices, top-

lighting potential still exists for lower floors in multi-story buildings. **Typical Climactic and Daylight Conditions** Even in moderate climates with typically cloudy weather trends, top-lighting still provides exceptional daylighting potential all day long.

**Interior Climate Control System** Appropriately designed HVAC systems are critical in any energy conservation effort. Non-residential – Automated lighting controls are critical in multi-user environments such as offices and retail spaces to ensure lighting energy is not used when daylighting is sufficient.

Residential – Although automated systems are becoming more readily available, generally no additional automated controls

are required as homeowners are increasingly conscious about energy conservation and savings.

**Fenestration Design** Advances in both glass and plastic glazing as well as other system components have improved thermal performance characteristics, such as insulation and solar heat gain control. Modern glazing can reduce the amount of glare resulting from direct sun exposure and/or diffuse the light into a larger area of interior spaces.

For top-lighting, light well design and/or tubular products can be very useful in directing/reflecting light into larger areas of floor space.

Remember, the overriding goal of any daylighting design is how well it uses the available light. However, uncontrolled daylight may result in excessive heat gain and potential discomfort. It is important to ensure that the fenestration is appropriately sized and located and that the correct glazing and accessories are selected. Use the fenestration area wisely to help insure the energy benefits balance the costs. For more information about daylighting visit the Skylight

Council website at <http://www.aamanet.org/skylight>.