Harnessing the power of sunlight
By Grant Grable, SUNOPTICS – An Acuity Brands Company

Daylighting is a building solution that, when done correctly, not only reduces energy use (by as much as 30-50 percent of a building’s electric lighting usage), but also provides the most effective light for the human eye. Electric lights simply cannot provide the full spectrum of color that is available from the natural light of the sun.

While the concept of daylighting and the ensuing energy savings seems intuitive—use natural light as your light source and save energy by shutting off electric lights—it must be designed carefully to avoid solar gain and glare.

The modern application of daylighting is attributed to architect Frank Lloyd Wright. In the early 1900’s he helped design prismatic window tiles for the American Luxfer Company in Chicago. The American Luxfer Prism was a four-inch square sheet of glass with a 3/16-inch thick prism inside to direct light into industrial buildings. Wright added a floral pattern to the prism to reduce the glare while still bringing natural light deep into the building.

Today’s building design professionals have many applications to choose from in designing daylit spaces. In this article we’ll focus on various types of roof top daylighting devices that can bring natural light deep into a building. These include active skylights with mirrors, passive skylights, including prismatic skylights, tubular skylights, clerestory windows and light shelves.

Two important factors for roof top daylighting devices are visual light transmission (VLT) and light diffusion. The goal is to bring in the most amount of light, properly diffused and without hot spots. This will minimize glare and UV-damage to the interior.

Skylights
There are several things to keep in mind when using skylights to introduce daylight deep into a building:

- Skylights are often easier to implement in buildings with tall ceiling heights. In these buildings, the skylight’s light is more easily diffused over greater areas.
- The optimal skylight-to-floor ratio often falls between 3% and 5%. However, it is very dependent on the building’s usage and local climate.
• The low U-Value of skylights means that they can raise a building’s heating and cooling energy usage. However, these penalties are small compared to the electrical energy saved by shutting off the lights.

• Since the lighting savings are so big, it is important to let in as much daylight as possible. So, it is crucial to maximize the skylight’s visible transmittance.

• They are effective in buildings with 7-day operation. This is because more lighting energy is available to be saved.

• The cost of light wells extends their payback periods. Therefore, they are often more attractive in buildings without drop ceilings.

**Prismatic skylights**

Prismatic skylights contain at least one layer of prisms that both reflects and refracts sunlight—diffusing it as it enters the building and distributing it evenly so that hot spots and glare are eliminated. The advantage of prismatic skylights is that they provide 100% diffusion without dramatically reducing the light output. This allows daylight to be used effectively for more hours. Conventional skylights diffuse light by using semi-opaque surfaces which knock down the light transmission to aid in diffusion.

**Clerestories and light shelves**

Clerestories are another strategy for bringing daylight deeper into the building and are used to bring in light in high spaces, those generally with ceiling heights of 15-20 feet or more.

The drawback with clerestories, however, is that they can produce glare. Proper shading is one way to correct this problem. In the northern hemisphere, however, another strategy is to install north facing clerestories and you won’t need to worry about glare or shading.

Light shelves are often used in concert with clerestory windows. These shelves stick out from a building to divide the clerestory window (above seven feet) and the view panel (below seven feet) to provide shading for the view panel portion. A light shelf that sticks out of the building at an appropriate length can provide summer shading for the view panel, thus reducing solar heat gain during the summer.

**Benefits of daylighting**

High performance daylighting, using lighting controls and high visible light transmission glazing with maximum diffusion allows you to not only maximize the hours you can eliminate electric lights on an annual basis but also reduce the heat in the building even during the summer months. It is a technology that can make a dramatic impact on electric energy use around the world. And it provides an environment in which people thrive—students in daylit schools achieve higher test scores, daylit retail stores have higher sales, daylit hospitals and senior care facilities report faster healing and businesses report higher productivity and less absenteeism in daylit offices.

The cost of implementing daylighting systems in buildings where it makes sense is a fraction of the cost of installing renewable energy technologies. Yet, daylighting is being used in less than 5% of the buildings where it would be an effective strategy. For more information on daylighting design, visit the [Daylighting Collaborative](#).

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