



WHITE PAPER

DAYLIGHT

An overview of natural daylighting and its benefits



Hawaii Prep Energy Lab
– A LEED® Platinum project
featuring SunSky® PC panels



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BUILDING GREEN. It seems everywhere we look there is some kind of statement or message about green building and the environment. While the greening of America is a noble trend, it can be time-consuming to wade through all the information and figure out what is not only truly good for the environment, but good for your bottom line, and good for your customer's bottom line too. Implementing natural daylighting in a building project is an easy way to gain a quick return on investment while going green, and doing so can also contribute to LEED® credits. You won't have to learn about any new contraptions or complicated installations. Many of you are already integrating daylighting into your projects. If you are, great! Stick around though, you might learn even more.

What is it?

First, what is daylighting? Daylighting is the use of glazing to allow natural light into spaces, often replacing the use of artificial light. By glazing, we typically mean glass or plastic. This article will focus primarily on plastic, specifically polycarbonate. There are two types of daylighting options, top lighting (skylights and roof lights) and sidelighting, often called clerestory windows. Shelf lighting, adding a reflective shelf in front of the glazing, is also a popular solution to introduce more daylight into the building. Traditionally, daylighting has been used in agricultural applications where electricity is unavailable or simply is not cost effective in areas such as loafing sheds, fertilizer storage buildings, and animal confinement buildings and so forth. Today, in addition to those traditional agricultural uses, natural daylighting is used in high-end architectural projects, retail facilities, hospitals, schools, offices, warehouses and more.

Energy Codes and Energy Savings

Energy codes are the driving force behind the green movement. Most of you are probably familiar with these codes, but we'll make a quick mention of them for reference. ASHRAE 90.1 2010 places standards on energy efficiencies in building, except for low rise buildings. ASHRAE 189.1 is the standard for design of high performance, green buildings, except for low rise residential buildings. Title 24 includes energy efficiency standards for residential and nonresidential buildings. While Title 24 is officially part of the California Energy Code, it is important to note that codes beginning in California typically make their way through the rest of the country and are accepted as best practices before becoming actual codes in each locality. The International Code Council (ICC) has recently created the International Green Construction Code (IgCC), which

provides a baseline of energy efficiency from the building design phase on through occupancy.

All of these codes focus on modifying building construction and renovation practices to save energy in safe, practical ways. First and foremost, daylighting saves energy. Introducing natural light into the building means artificial lighting can be turned off or dimmed. This can be done manually (open loop), or there are photocontrols available that use sensors to read the natural light coming in the room and will adjust the artificial lighting automatically (closed loop). In addition, artificial lighting creates heat inside the building. Having the ability to dim or turn off the artificial lights greatly reduces the cooling load. According to the USDOE, two of the highest energy uses in a building are lighting and HVAC. Determining exactly how much energy can be saved depends upon the energy efficiency (U factor) of the skylights or sidelights, as well as the type of artificial lighting being dimmed or switched off. To determine the exact calculations, there are a number of websites that can assist; one option is the United States Department of Energy (USDOE) website at www.eere.energy.gov. You can also visit the Metal Building Manufacturer's Association (MBMA) website at www.mbma.com for more information on sustainability or to obtain their Energy Design Guide for Metal Building Systems manual. For more information on how Palram products may contribute to LEED® credits, please see Palram's Products for Sustainable Building, form 5003.

Other Benefits of Daylighting

To understand how daylighting affects humans, we have to delve into physics a little bit. I promise it will be painless. The electromagnetic spectrum of radiation transmitted from the sun is called the solar spectrum, comprised of Ultra Violet light, visible light, and infrared light. The visible light spectrum is essential for proper visual performance, and to reduce the effect of metamerism, specifically illuminant metamerism failure, where colors will appear differently in different sources of light. Put more simply, natural light is the best source for color comparisons. Artificial lighting, even the options that claim to be full spectrum lighting, lack most of the blues in the spectrum, causing eye strain and poor visual performance.

Natural daylight also offers benefits that create positive changes in people. As you know, humans operate under a circadian rhythm. This physiological process supplies us with an inner clock. The introduction of daylight is one of the most important factors in

keeping this process in line. When the circadian rhythm is upset due to lack of daylight, this can contribute to a multitude of problems, including hormonal imbalances, sleep disorders, and mood disturbances. Along the same lines, daylight is also beneficial in preventing such afflictions as Seasonal Affective Disorder (SAD) and even Sick Building Syndrome (SBS).

As we all know, happy humans are more productive. Whether it means shopping longer and buying more items in a retail facility or by producing a greater percentage of widgets at the factory, daylight helps motivate people to do more.

Daylighting Integration

Now that we’ve covered the benefits of daylighting, what are some of the ways it can be implemented into your next project? There are many configurations available for skylights, including a checkerboard style, ridge-to-eave, mid-span, continuous or horizontal, and saw tooth or north lights, or side lighting (vertical or horizontal) (See fig. 1). When determining where to place sidelights, a north or south facing wall is best for more even lighting for longer portions of the daylight hours. East and west facing sidelights often have harsh glares and provide light for only short portions of the day. For additional or total light diffusion, optional pigments can be added to the glazing to diffuse the natural light, reducing glares and hotspots, and helping to spread the light throughout the structure of space.

Installation

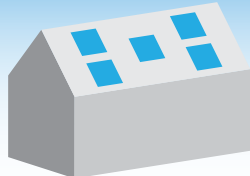
Installing polycarbonate skylights or sidelights is relatively easy. The corrugated panel installation is virtually the same as any corrugated metal roofing or wall panel with the exception of pre-drilling holes and the type of fastener used for proper installation. The pre-drilling is necessary to allow for expansion and contraction, as polycarbonate expands and contracts at a different rate than metal. Rubber butyl tape or a compatible silicone caulk, along with positive drainage, should alleviate any leakage concerns with skylights. Leaks typically aren’t a concern with sidelight applications. Multi-Wall skylight or sidelight installation is equally as painless as the corrugated installation. There are a few additional accessories used in the installation: A snap HCX channel which is used to join 2 panels together in the longitudinal direction, breather tape for the top and bottom ends of the panel to keep out dirt and debris, and U channels which hide the unfinished sides and ends of the panels. As is the case with the corrugated skylights, all fastener holes must be pre-drilled to allow for thermal expansion of the material. Be sure to read the entire installation guide for any chosen skylight or sidelight system to ensure proper panel performance.

Life Expectancies & Warranties


Most polycarbonate manufacturers offer some type of warranty against discoloration and impact resistance against hail for up to ten years, although many polycarbonate installations have been in place for 20 years or more.

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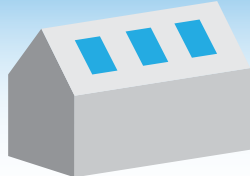
Sky, Roof, and Side Light Placement Options & Terms



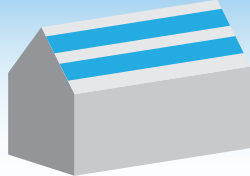
Checkerboard




Ridge to Eave




Mid Span



Continuous or Horizontal



Saw Tooth or North Lights



Side / Wall / Window / Skirt
(Horizontal or Vertical)

The impact resistance of polycarbonate is far superior to other materials available on the market. Commercial warranties might be a bit different considering the product might be installed in an area where it could be subjected to chemical attack (i.e. waste treatment facility or harsh cleaning compounds). It is important to note that UV inhibitors add to the life expectancy of polycarbonate panels. A co-extruded UV layer creates a more permanent bond and will not delaminate or crack.

Recycling

In addition to a potentially 20 plus year lifecycle, it is important to note that once the polycarbonate panels need to be replaced, they are 100% recyclable, which lessens the waste in landfills.

Summary

The economical and societal impact of implementing natural daylighting far outweighs the use of artificial lighting. Daylighting not only saves energy, but also produces positive results in human performance and moods. So, while the electric bill is going down, the shoppers are buying more in retail facilities, the children are doing better on tests in schools, the factory workers are more productive, and the cooling load in the building is dramatically reduced. Polycarbonate skylights and sidelights are among the most durable options available and allow for full spectrum lighting to be introduced into the building to produce those positive effects, plus offer the opportunity for LEED® credits for your project. As

energy codes become more stringent, daylighting is going to be even more important in both new construction and renovations. Implementing daylighting in your current projects will put you ahead of the competition and provide valuable experience for the coming years.

About PALRAM Americas

With 50 years of expertise in the industry, PALRAM has established manufacturing, distribution and sales operations across seven continents and 120 countries around the world. Palram markets its products to the sign and graphics market, as well as to the commercial, industrial, residential, marine, and do-it-yourself construction markets.

Palram corrugated polycarbonate products are sold under the trade names SUNSKY® and SUNTUF®. Palram also offers the MetalMatch™ technology, allowing the use of SUNSKY polycarbonate panels for daylighting options with virtually any metal profile available. SUNSKY is offered in a range of colors, including a soft white to eliminate glare. Palram also offers SUNLITE®, a multi-wall polycarbonate sheet for skylights, roof lights, or sidelighting applications.

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