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A REPORT ADVOCATING  
FOR SOCIALLY RESPONSIBLE  
SUSTAINABLE DEVELOPMENT

# INNOVATIVE COMMERCIAL SKYLIGHTS INSTALLED BY GLOBAL 500 REALTOR

ENEREF INSTITUTE EXAMINES HOW A WAREHOUSE SPACE MANAGED BY CBRE INSTALLED AN INNOVATIVE DAYLIGHTING SYSTEM

As the world's largest commercial real estate services and investment firm, CBRE plays an important leadership role in determining industry best practices within the 5 billion square feet of building facility space they manage.

CBRE's management knows that natural interior daylight has a positive impact on workplace health and productivity and, as such, skylights were incorporated in the warehouse space that CBRE leased to VELUX Company—themselves a leading manufacturer of skylights.

# WE FOUND IT SIMPLY DOES A BETTER JOB WHEN THE SUN IS LOW IN THE SKY.

MARK JONGEWAARD | LTI Optics

“It is our policy to implement environmentally sustainable best practices and to meet both the letter and the spirit of all environmental laws and regulations where we do business,” according to the CBRE 2016 Corporate Responsibility Report.

What resulted when VELUX leased their Reno, Nevada, warehouse and distribution space from CBRE Group was the installation of an entirely new commercial daylighting system.

## INCREASED ALL-DAY LIGHTING

Because VELUX had just introduced a new skylight to the commercial marketplace, branded Dynamic Dome, it was naturally the preferred skylight system for the new space leased from CBRE.

The geometry of the Dynamic Dome is designed to bring a considerable amount of daylight into the building throughout the entire course of the day. The pattern of ridges and ribs, as well as the taller dome shape, presents a large surface to capture and transmit sunlight, even when the sun is low in the sky.

To achieve maximum results, the dome-shaped skylight has a smooth, clear outer dome and a white prismatic inner dome. This configuration allows for 100% light diffusion and 20% more daylight harvesting.

“We found it simply does a better job when the sun is low in the sky,” explains Mark Jongewaard of LTI Optics, whose study demonstrated the efficiency and lumen output of the Dynamic Dome. “The device brings in a usable amount of light earlier and later in the day.”

## NO AIR LEAKAGE OR CONDENSATION

Any potential loss of heat, or climate-controlled air, through the dome frame is prevented by an impenetrable thermally-broken water barrier.

Although common, water condensation on skylights is often wrongly assumed to be leakage rather than water that collects as droplets when humid air comes

into contact with the skylight’s cold surface. To eliminate condensation build-up, a wicking system evacuates water to the building exterior, while a one-piece frame ensures watertightness.

## REPLACING COMMERCIAL DOME SKYLIGHTS WITH DYNAMIC DOMES

The CBRE space already had large dome-shaped skylights when VELUX moved in.

Sun Tunnels, a tubular daylight device, were later added to illuminate the offices of the new VELUX Warehousing and Distribution Center. Sun Tunnels are designed to carry natural daylight long distances from the roof, where installing a traditional skylight may be structurally prohibitive.

When VELUX moved into the new space, they replaced the existing skylights with Dynamic Domes, leaving a few of the original skylights in place for comparison. The project’s general contractor, Paul Slocum of Montane Building Group, said that the newer skylights “actually bring in more light than the ones that were installed. I think it’s a better product.”

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AS PART OF OUR NATURAL INTERIOR DAYLIGHT INITIATIVE, *Eneref Institute* interviewed participants in the planning and implementation. Interviewees included, Mark Jongewaard of LTI Optics; James Andrews, Electrician with Jenson Electric; David Lytle of Kodiak Roofing, Frank Tiernan and Russell Hines from the VELUX Warehouse and Distribution Center; and Robert McGrath, Senior Director from CBRE.



## TALLER DOMES

*Designed to improve daylight harvesting when the sun is on the horizon*

### NEW PRISM CONCEPT FOR SKYLIGHTS

VELUX determined their dome skylight system could achieve the greatest lumen output with a diffused white, upward-facing prismatic dome beneath a clear, smooth outer dome shell. A report by LTI Optics verified the results. (See sidebar).

“If your prisms are up, facing the light source, you’ll get more light output,” explained engineer John Lawton, Skylight Manager for VELUX Global Product Management. “It’s the physics, how the light refracts.”

### TALLER DOMES CAPTURE MORE LIGHT

Dynamic Domes were designed to improve daylight harvesting when the sun is on the horizon, at a lower angle. The taller, steeper

base of the dome allows for more light collection early and late in the day. The geometry ensures a lower angle of incidence, where more sunlight is refracted into the warehouse space than is reflected outward.

“We wanted to design something that can capture even more light and then refract that down into the opening,” says Lawton.

The efficiency is highest at just a 10% solar angle because the collected light is high with respect to the relatively low horizontal illuminance at this sun angle.

“Optically, the Velux Dynamic Dome has a combination of good materials that diffuses the light with an advantageous geometry,” said Mark Jongewaard of LTI Optics.

### REDUCED ELECTRICAL LIGHTING COSTS

An important benefit of having more light output from the skylights is greater energy savings from electrical lighting. The warehouse installed photo sensors to shut off electric lights when a sufficient amount of daylight filled the warehouse. Motion detectors were also installed. According to Frank Tiernan, the warehouse distribution manager, the skylights offered more than enough light to reduce their use of electrical lighting.

“Once the new skylights were installed, we noticed the lights weren’t coming on anymore. I attribute that to a lot more daylight coming into the building,” said Tiernan.

For a large, non-conditioned warehouse-style building, electrical energy for lighting can be a substantial operational cost—up to 71% of total energy consumption.

“Skylights can significantly reduce energy costs while still meeting the required light levels,” explained Ross Vandermark, national product manager for VELUX America. “So it’s a race each day to turn off the lights in favor of free, natural daylight.”

Extrapolating from the LTI study, Dynamic Domes can harvest 56 more minutes of sunlight per day than the previous VELUX system—potentially saving 340 hours of energy annually.

### ADDING VALUE ADDITIONAL WITH TUBULAR DAYLIGHT DEVICES

Sun Tunnels were installed into the roof after the construction of the facility was completed and the building was occupied.

“Generally owners are reluctant to have contractors drill holes in their roof,” explained general contractor, Paul Slocum. “The owner didn’t have an issue with it because they knew that natural daylight adds value to their building.”

To retrofit the Sun Tunnels, Slocum hired the same roofing contractor that had worked on

the original construction project, Kodiak Roofing. Kodiak Roofing honored the original warranty on their work.

### NO NEED TO REPLACE THE SKYLIGHT CURBS

The construction team employed a scissor lift inside the building to

hoist each acrylic dome up to the ceiling, one at a time.

“The guys would pop off the old domes, lift the new Dynamic Dome up, and pop them on,” explained warehouse manager Frank Tiernan. “We didn’t have to replace the skylight curb mounts.”



## THE *SciBox*:

# EFFICIENCY & LUMENS

*LTI Optics determined skylight performance measuring optical efficiency and lumen value.*

**THE LUMEN COLLECTION** performance is a function of the size of the device, increasing as the device area increases. An acrylic 5' x 8' Dynamic Dome product achieves efficiencies ranging from 71% at a 10° solar altitude to 57% at 90° and 63% at 10° to 49% at 90° for the polycarbonate version. This results in lumen collections ranging from 37,000 at a 10° sun angle to 250,000 at 90° for acrylic and 31,000 to 215,000 for polycarbonate.

*LTI Optics defines the optical efficiency of a skylight device as the output lumens divided by the input lumens (the total horizontal illuminance from the sun and the sky, times the horizontal cross sectional area of the device.)*



## NO CONDENSATION

*A wicking system evacuates condensation to the building exterior.*

Each 4-foot-by-8-foot skylight dome required about 30 minutes to replace, according to the GC, Paul Slocum. The entire skylight retrofit project was completed in just one day.

## ADDITIONAL COST SAVINGS FOR RACK WAREHOUSING

The 82,000-square-foot warehouse is filled with 24-foot-high racks. The warehouse space is not air-conditioned but uses two efficient Cambridge heaters during winter months to reduce energy costs. The entire building is 400,000 square feet.

For evening hours or periods when daylight alone is not sufficient, James Andrews of Jenson Electric installed T8 high-bay fluorescent luminaires between the 24-foot-high shelf racking. Andrews aimed for 30 foot-can-

dles at a 36-inch working plain but achieved 30 foot-candles of light down to just 30 inches above the floor.

In a warehouse with racks, the energy savings from skylights can be triple that of a large open space because narrow shelf racking blocks light from electrical fixtures, requiring three times as many fixtures to illuminate the same amount of space.

The roof was covered with Georgia-Pacific DensDeck and 60 mil JM TPO single-ply membrane, according to David Lytle of Kodiak Roofing & Waterproofing.

## A NEW OPTION IN COMMERCIAL SKYLIGHTING

General contractor Paul Slocum reported that when comparing the originally installed sky-

light domes with the retrofitted Dynamic Domes, the increase in brightness was noticeable.

“It feels brighter when you walk into the space,” said Slocum. “Velux left one of the old skylights in place—which was smart—so when clients walk through, they can show the difference,” said Slocum.

Asked if he would specify Dynamic Dome skylights in the future, Slocum responded, “If we do another building, then I will definitely look into it and actually ask for a proposal for them to provide the skylights for the jobs.”



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We launch initiatives designed to encourage the best that commerce has to offer—for people and for our planet. We promote the idea that being resource-efficient and socially responsible is also profitable. Our Advocacy Reports demonstrate the benefits of successful solutions.

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***THE NATURAL INTERIOR DAYLIGHT IS A CAMPAIGN TO PRESERVE OUR NATURAL RESOURCES AND PROMOTE BETTER LIGHTING IN OUR HOMES AND BUILDINGS.***

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**ENEREF INSTITUTE** launched the Natural Interior Daylight Initiative to champion solutions in line with our mission that deliver sound ideas to significant market influencers. The initiative is designed to encourage responsible behavior within public and private organizations, municipalities and corporations by

offering common-sense solutions that achieve effective results.

Our Virtual Campus is the repository for our Advocacy Reports and Web Forums.

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