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THE BIMONTHLY NEWSLETTER OF THE DAYLIGHTING COLLABORATIVE

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DAYLIGHTING collaborative®

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TUBULAR DAYLIGHTING FOR COMMERCIAL RETROFIT APPLICATIONS—IT'S NEVER TOO LATE TO DAYLIGHT

By Neall Digert, Ph.D., MIES

Neall Digert is Vice President of International Market Development for Solatube International, Inc.

Tubular Daylighting Devices (TDDs) offer a way to bring natural daylight into interior spaces. They are being specified for all types of commercial structures—from schools to warehouses—as an effective and affordable daylighting strategy. Furthermore, TDDs are playing an integral role in commercial retrofit projects specifically aimed at maximizing energy and cost savings.

According to a recent report from McGraw Hill Construction*, green building represents 5 to 9 percent of retrofit and renovation market activity by value. The market for major retrofit projects will grow to 20 to 30 percent in the next five years, predicts the report, and half of all retrofits and renovations will be green within the next 15 years. TDDs are an easy and innovative way to incorporate green building practices now and in the future.

DAYLIGHTING WITH TDDS: THE BENEFITS

Providing adequate daylight penetration through typical side-lighting techniques can be challenging, and the range of traditional skylights is limited to the top floor of a building. TDDs, however, use advanced reflective and refractive optical components to collect and redirect daylight into a building. These characteristics afford new daylighting opportunities for retrofit applications that have not been possible using traditional daylighting technologies such as windows and skylights. Not only can TDDs bring daylight deep into a facility, but through the use of unique optical tubing systems with angle-adapters, they can route daylight through multiple floors of a building, transporting it both horizontally and/or vertically over very long distances.

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**Green Building Retrofit & Renovation: Rapidly Expanding Market Opportunities through Existing Buildings*, McGraw Hill Construction, October 2009

END OF AN ERA

The Daylighting Collaborative's longtime champion, Abby Vogen Horn, has left the Energy Center for a position with Franklin Energy Services. Nearly 12 years ago, Abby joined the Energy Center and began her crusade to bring daylighting knowledge and resources to building design professionals. Her efforts resulted in the development of several technical curricula, numerous training and speaking engagements and the Daylighting Collaborative.

Abby leaves the Energy Center, but not the energy efficiency, high performance building community. She joins Franklin Energy Services as Director of We Energies Programs where she will continue to have a voice in developing programs that push high performance building and daylighting. We will miss Abby's passionate advocacy for lighting every building using the sky, but look forward to continuing to work with her in her new position.

Management of the Daylighting Collaborative will reside in the capable hands of Peggy Heisch. Peggy will draw on technical staff from the Energy Center to provide continuing support for the Daylighting Collaborative.

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There are several other major benefits to adding TDDs to commercial retrofit projects:

THE BOTTOM LINE. Daylighting saves energy by allowing occupants to turn off electric lights during the day. The Federal Energy Management Program reports that up to 50 percent annual energy savings can be achieved when daylighting is added to a project, allowing the electric lighting equipment to be turned off during daytime hours.

INCREASED PROPERTY VALUES. Energy-efficient building design can significantly increase the resale value of a property. Because these buildings cost less to operate and maintain, energy savings contribute directly to the income of the asset. Daylit properties are also likely to rent faster and for higher rates. The Electric Power Research Institute estimates that daylit buildings can result in 10– to 20–percent higher rental income than those that are lit through only electric lighting equipment.

A BETTER ENVIRONMENT. Several prominent studies have shown that increasing daily exposure to natural light can enhance mental and physical well-being, boost concentration and energy levels, and provide a variety of other unexpected perks.

ACHIEVEMENT OF LEED CREDITS. Daylighting plays a pivotal role for those seeking green certification credits for their projects through the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED™) program. TDDs can contribute to the achievement of LEED milestones across all LEED rating systems and in several categories, including Energy and Atmosphere, Innovation in Design and Indoor Environmental Quality.

SPECIFYING AND APPLYING TDDS TO COMMERCIAL RETROFIT PROJECTS

Proper specification and application of TDDs is critical to obtaining the energy efficiencies sought. A specifier must take into account the varying components of the TDD to understand how to achieve the required results. To this end, the attributes of the following three components of TDDs—Capture, Transfer and Delivery—are particularly crucial.

CAPTURE. For a TDD to bring daylight into interior spaces effectively, daylight capture must begin at the roof level. With various technologies being used to harness daylight in TDDs, the differences begin at the dome. Products can range in technology from thermally formed, clear plastic domes to more advanced systems that utilize optics, either reflective (mirrored reflectors) or refractive (lenses), to maximize daylight collection. There continue to be industry advances in low-angled light collection, which is especially important for the winter months, in high latitudes, and in climates with frequent overcast skies. Knowing and understanding the differences in the qualities of the domes can help specifiers prescribe the system that

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UPCOMING EVENTS

The LIGHTFAIR Daylighting Institute is scheduled for May 10–11, 2010 at the Las Vegas Convention Center in Las Vegas, Nevada. This two day conference precedes the **LIGHTFAIR Tradeshow and Conference** May 12–14, 2010. Topics at this year's Daylighting Institute include: Designing Photoresponsive Control Systems, Daylighting Simulation Tools, Daylighting Metrics, Design of Electric Lighting Controls for Daylighting and much more. Visit **www.lightfair.com** for more information on the program and registration.

TECHNOLOGY AND RESEARCH UPDATE

The California Lighting Technology Center (CLTC) is a research organization started in 2004 and is affiliated with the University of California–Davis. This organization conducts research and product development in partnership with the private sector.

A recent project focuses on the development of a self-commissioning dual loop sensor dimming technology for daylight harvesting. This project is being conducted in partnership with WattStopper/Legrand, WalMart, Sacramento Municipal Utility District, Southern California Edison and San Diego Gas and Electric to develop a daylighting control system with increased reliability in sensing daylight variations within the space.

For more information on this and other CLTC daylighting research efforts, go to **http://cltc.ucdavis.edu**

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COURTESY OF DOE/NREL, CREDIT—KENT BULLARD

Tubular skylight, Channel Islands National Park.

meets the most stringent daylighting and energy efficiency requirements for a building's location and interior daylighting requirements.

TRANSFER. From the dome level, daylight is captured and transferred through modular optical tubing, which systematically affects the daylight transport from the rooftop aperture to the ceiling diffuser. This optical element is what makes retrofit application of daylight truly possible. Using advanced reflective materials and technologies, the topical tubing of TDD systems allow daylight to be redirected and transported through the interstitial spaces (i.e. plenums, walls, daylight chases) from the rooftop aperture location to the ceiling-mounted diffuser. In essence, the optical tubing allows the daylight collected at the TDD dome to be "ducted" through the building and around potential obstructions. When measuring tubing performance, the differences tend to be in the material used and its optical reflectivity. There are two major components of reflectivity that collaborate within a TDD: 1) specular reflectance, and 2) spectral reflectance. Tubing types can include corrugated/flexible tubing, enhanced anodized aluminum, metalized surfaces and the more advanced non-metalized film technologies. In the end, the goal of the tubing technology is to maximize the amount of light that is transported through the tubing system and minimize the potential for any color shift of the light during the transportation process.

The most advanced TDDs use unique non-metallic optical surfaces in the tubing system. These surfaces have a very consistent spectral reflectivity across the visible spectrum thereby virtually eliminating any color shift of the reflected and transported daylight. They also have a high specular, or mirror-like, reflectance of over 99.7 percent for visible light only. These unique tubing systems can transport light over very long distances with minimal light loss. When used in TDD systems with a 21-inch (530mm) diameter optical tube, this super-reflective system has been able

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DAYLIGHTING COLLABORATIVE MEMBERSHIP

Join the Daylighting Collaborative and connect with the design and construction professionals who need your products and services to deliver sustainable, energy efficient, carbon neutral buildings. Membership will connect you to more than 10,000 highly motivated and qualified customers who are looking for products and technical solutions. Align your organization with an objective, nationally-known resource for design professionals who want to incorporate daylighting into their designs. Contact Peggy Heisch at 608.238.8276 x139 or **pheisch@ecw.org** for more information.

THE DAYLIGHTING COLLABORATIVE WELCOMES A NEW MEMBER!

Ciralight Global, Inc., headquartered in Irvine, California, has over 25 years of research and development in the technology of daylighting. They are a leading provider of advanced daylighting products. Ciralight Global, Inc. is building upon a long track record and history in the daylight industry with its roots dating back initially to So-Luminaire, Inc., the original pioneers of solar tracking skylights.

We're grateful to all our members for their generous support and collaboration in developing and delivering the resources the building design community needs to light every building using the sky.

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to deliver daylight more than 100 feet from where it was actually collected by the rooftop dome and flashing system.

DELIVERY. At the ceiling, TDDs use optical diffusers to provide controlled daylight distribution in very precise ways. Light spread, color temperature, and minimization of glare can all be greatly affected by the diffuser's design and specification. More advanced TDDs also offer optical modulation systems, allowing users to control light output through optical dimming. Some TDD dimming devices can be integrated into the building's lighting control systems, while others offer a wall-mounted rocker switch, allowing building inhabitants to modulate the daylight or set scene-level controls for demanding multi-use environments, such as classrooms and boardrooms. Varying lens technologies are also available for TDDs, from basic prismatic designs to highly engineered Fresnel lenses. The choice of diffusion can be based simply on aesthetics or on the need for precise placement of light within the occupied space. The advanced TDD systems provide a range of diffuser options, providing distribution patterns ranging between focused lighting and more widespread diffuse lighting. In the end, the diffuser technology is the critical element, allowing the lighting designer to consistently place the light where and how it is needed in order to create the desired effect. ■

DID YOU KNOW…

BALLAST FACTOR

Daylighting design is integrated with lighting design. To achieve overall efficiency, you need to be aware of the various components and performance of the electric lighting system. The ballast factor is a performance metric that measures the actual lumen output for a specific lamp-ballast system. Ballast factor is not a measure of energy efficiency. A lower ballast factor reduces lamp lumen output; it also consumes proportionally less input power. Careful selection of a lamp-ballast system with a specific ballast factor allows designers to minimize energy use by "tuning" the lighting levels in the space. In new construction, high ballast factors are generally best, since few luminaires will be required to meet the light level requirements. In retrofit applications lower ballast factors may be more appropriate.

Lamp-Ballast System efficacy (lumens/watt) = number of lamps X ballast factor