



THIS CASE STUDY WAS EXCERPTED IN

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## DAYLIGHTING BRIGHTENS SCIENCE CLASSROOM FOR TEXAS JUNIOR HIGH SCHOOL

ENEREF INSTITUTE EXAMINES HOW THE RIGHT TUBULAR DAYLIGHTING DEVICES SAVE ENERGY WITH A COST EFFECTIVE RETROFIT.

“Overall it’s great – the kids definitely enjoy having natural light in there,” declared William Teal about the sunlight now streaming into the ceiling of his science classroom. “It’s just a much more natural feel.”

Teal is a science teacher with Alvin Junior High School in Texas, who has benefited from his classroom’s recent retrofit with rooftop tubular daylighting devices. While he appreciates the look and feel of the new daylighting system installed in his science classroom, what

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really sold Teal was the Texas-sized thunderstorm that knocked out a transformer leaving the school without electricity. The entire school went dark, except for Teal's classroom. In fact, the rooftop daylighting system is even "high velocity hurricane zone" approved.

"Lightning struck the transformer and the lights went out," explained Teal. "We had enough light in my room -- still with it being overcast -- my kids kept working."

## ARCHITECTURAL DESIGN

When CMTA, the school's the consulting engineering firm, helped Alvin Junior High School test the retrofit of a tubular daylighting device (TDD) in Teal's science classroom, the engineering firm was already a leading national advocate for daylight harvesting.

"We specify daylighting devices all over the country," explained Clint

Young, a LEED certified engineer with CMTA.

CMTA is responsible for new and retrofit classrooms in the twenty-two buildings school system of the Alvin School District, situated just south of Houston, TX.

The fastest, easiest way to bring daylight into an existing building is with a skylight or tubular daylighting device (TDD). A well designed system can capture low angle sunlight - allowing daylighting for more hours - and uses adjustable elbows to bypass obstructions and transport the sun's rays some distance typically via a reflective specular material, thereby leading the rays through the building. A high performance prismatic lens will optimize light levels and eliminate unwanted glare and hotspots by diffusing the light. A specular reflective material will maximize the light levels.

According to Josh Campbell, Dis-

trict Energy Manager for the Alvin school system, CMTA Consulting Engineers are technology "pioneers" and credits CMTA for building the confidence Alvin needed to implement energy innovations, like daylight harvesting.

Initially, Alvin and CMTA retrofitted six Sunoptics® LightFlex™ tubular daylighting devices from Acuity Brands with ALANOD® MIRO-SILVER® aluminum in the Alvin Junior High School science lab.

As Alvin School District's Director of Building Programs Jeff Couvillion explained, "We like to kind of stick our toe in the water before we jump in."

## HOW IT WORKS

Facilities with open or drop ceilings are perfect for tubular daylighting, where depending on cost of energy, systems can offer a 5 year ROI or less. And after the payback period, it's like money in the bank.

To achieve a completely glare-free room, Sunoptics used a prismatic pattern lens. The lens is optically designed to evenly distribute the sunlight coming in and drive it down into a light-well made of highly-reflective MIRO-SILVER® aluminum — a material designed for lighting applications because it reflects nearly one hundred percent of the daylight.

MIRO-SILVER, made by ALANOD,



#### THE RIGHT LIGHT LEVEL

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essentially squeezes every drop of light out of the system.

For the test, Couvillion “picked an interior science classroom with no exterior windows.”

Besides installing the tubular daylighting device in the science room, CMTA replaced the existing controls and fluorescent T8s, with new Lithonia 3 lamp T8 lensed troffer fixtures and a low-voltage nLight control system, in a one-to-one replacement.

To bypass any obstructions between the roof and the suspended ceiling, the LightFlex TDD system has adjustable elbows that can an-

gle the light rays. Light-controlling louvers adjusted the exact amount of daylight entering the room.

#### PRODUCTIVITY GAINS FROM DAYLIGHTING

There is plenty of evidence that daylighting improves occupant productivity in both schools and offices. Especially in learning environments, skylit classrooms provide a natural and stimulating space for teacher and student. The human productivity gains from daylight harvesting are significant, which has been proven to raise morale, increase productivity of students and workers, decrease product defects for numerous

industries, and even increase retail sales. According to Hescong Mahone (HGM), a leading daylighting consulting firm, studies for Pacific Gas and Electric looked at daylighting and human productivity and found positive results in elementary student test scores.

For students, day lit rooms that offer the right amount of light for the task at hand improve visibility and visual comfort, thereby enabling better recognition and legibility. For teachers, daylight can enhance learning activities through improved student moods and concentration while simultaneously reducing off-task behav-

# THE HESCHONG MAHONE STUDY FOUND COMPELLING CORRELATION BETWEEN DAYLIGHTING IN CLASSROOMS AND THE PERFORMANCE OF STUDENTS.

Students that had a well designed skylight in their room, one that diffused the daylight throughout the room and which allowed teachers to control the amount of daylight entering the room, improved 19-20% faster than those students without a skylight.

ior. And while administrators can benefit from improved student and teaching outcomes, they can also expect to see a lower energy and maintenance burden as well as better compliance with code standards.

## THE SYSTEM CAME TOGETHER

To guarantee best performance, CMTA supervised the rooftop installation with site visits, explained Young. CMTA used the same prismatic lenses on the daylighting system as on the fluorescent fixtures to assure a uniform appearance. An automatic dimming system was installed on the fluorescent fixtures to adjust the fluorescent light output to the amount of daylight entering the room at any given time. The system's optically-designed diffusers complement the light distribution aesthetics of the fluorescent fixtures.

While energy efficiency and increased student performance are the primary reasons Alvin is enthusiastic about daylighting, both teachers and students are pleased with the appearance of the new science room after the retrofit

was completed.

"The principal would be a great proponent of putting the same system in all the classrooms... it would have a lot of value for him," reported Couvillion.

Typically in a classroom environment, with artificial light alone – for example, at night with no available sunlight – CMTA looks to achieve 45 footcandles or greater in classroom environments. And depending upon where in the science room light readings were taken, 45 footcandles is approximately where the room ended up even with minimal help from the electric light source. Directly under a skylight, with just one electric light dimmed down to the lowest level, the measurements read exactly 45 footcandles. On the same spot with the electric lights completely off, the light measured 42 footcandles at desk level on the day the readings were taken. The lowest automatic dimming threshold point for the fluorescent lights can of course be reset to increase or decrease the footcandles coming from the electric lights as desired.

## BRIGHT FUTURE FOR DAYLIGHTING

"They're just super bright," said science teacher William Teal of the new tubular daylighting devices. "And, I appreciate not having the fluorescent lights just buzzing at me all day."

When CMTA first opened its Houston office, Young said the engineering firm had to spend a lot of time educating facility owners on the value of daylight harvesting through tubular devices. But once they built a few day-lit buildings, Young said "owners started realizing the quality and quantity of light it provides and how it completely opens up a space... it's become a much easier sell."

But more importantly, the students are already sold. William Teal said of his science students, "They do make comments like 'we wished other classrooms had this type of light.'"

*Research and reporting compiled and provided by Eneref Institute. (www.eneref.org)*