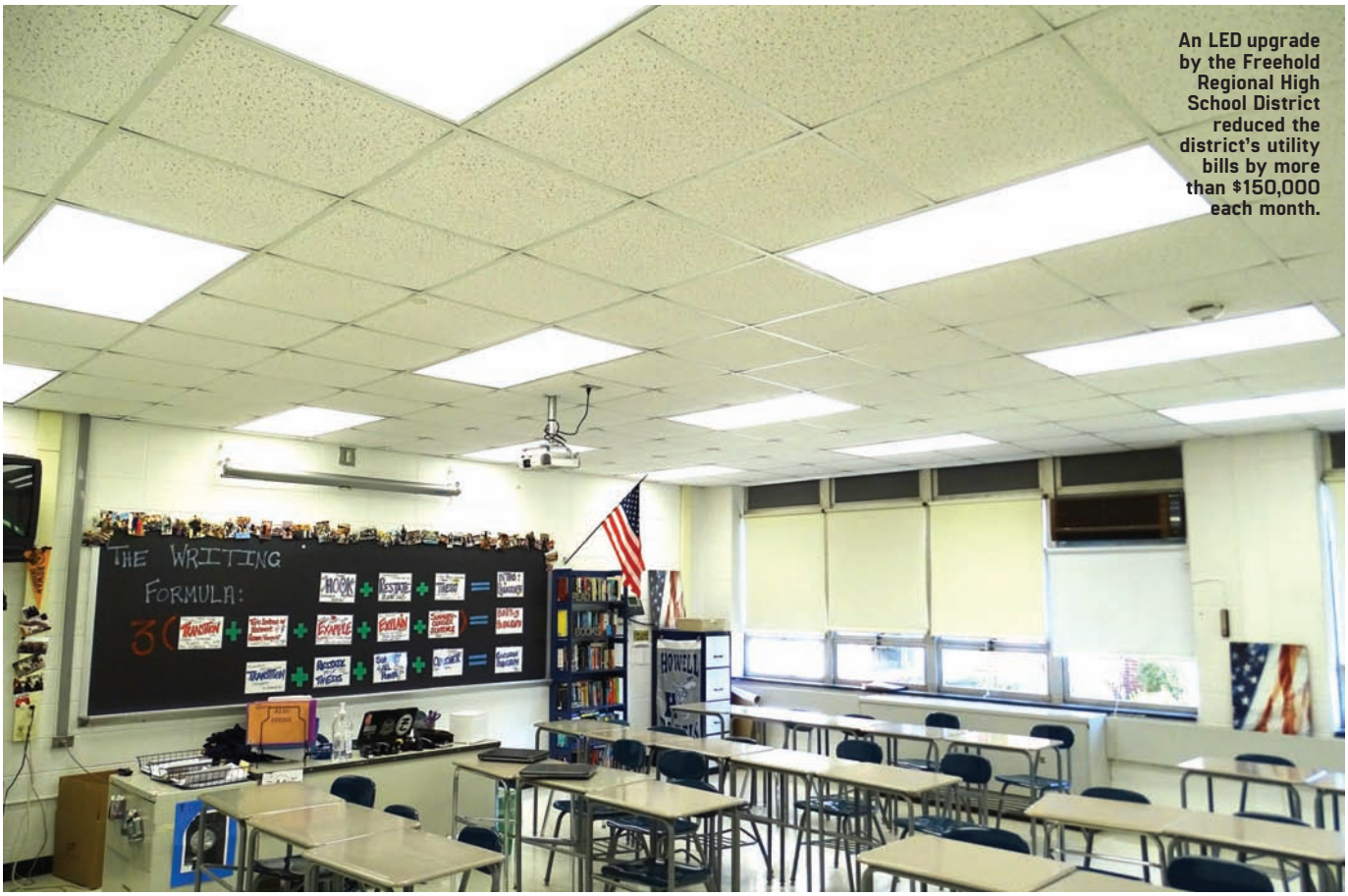

An LED upgrade by the Freehold Regional High School District reduced the district's utility bills by more than $150,000 each month.

IMAGE COURTESY OF FACILITY SOLUTIONS GROUP/FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OUTSTANDING IN THEIR CLASS

Facility Solutions Group and Green Creative help New Jersey's Freehold Regional High School District score an A+ in sustainability.

by **Susan Bloom**

SERVING 12,000 HIGH SCHOOL STUDENTS IN SIX different buildings located across five Jersey Shore-area towns, the Freehold Regional High School District devotes extensive resources toward its mission of "charting a future of excellence in education." The district's commitment to excellence extends to its buildings and grounds as well, so when an outdated lighting system was driving excessive energy and maintenance costs for the district, the Perth Amboy, N.J., branch of Facility Solutions Group (FSG) partnered with LED manufacturer Green Creative to support a district-wide lighting upgrade.

Completed in 2016, the project successfully enhanced lighting quality, delivered attractive energy savings, and significantly reduced maintenance costs and concerns, helping these schools move to the head of the class in the subjects of energy efficiency and sustainability.

Reducing the Strain

Pat Lagravenis, director of buildings and grounds, is charged with ensuring that all systems related to the school district's facilities and properties run in a safe and orderly way. "Our energy costs were huge," he said. "Our schools are open from 6 a.m. until at least 9 p.m. every night hosting academic, sports, and extra-curricular activities, and with that kind of volume, our lights are on a lot."

Although the buildings—all of which are about 250,000 square feet and range anywhere from 17 to 90-plus years old—were lit primarily with fluorescent T8 technology, "We had to stock fluorescent lamps and ballasts of all types and sizes and their special disposal needs required our in-house maintenance crew to have to collect them and deliver them to an outside company for processing, which was time-consuming," Lagravenis said of the continuous

strain the lighting system put on his 15 team members. "We knew that LEDs would last longer and offer tremendous savings in terms of labor and storage of material."

To address these concerns, the school district funded a lighting upgrade through a state-sponsored energy-savings improvement plan that financed the project through future energy savings. "After the district hired an engineer to create the scope of work, we bid on the project and it was awarded to us," said Stephen Malave, branch operations manager at FSG.

After proposing the use of LEDs from Green Creative—based on positive past experiences with the company and its technology—FSG received approval to order the products.

The project ultimately involved the installation of 32,000 linear LEDs throughout hallways, classrooms, and other common areas; hundreds of high-bay LEDs in the gyms; a variety of exterior wall packs and area lights to illuminate building perimeters and parking lots; and more than 600 occupancy sensors. "The project represented the second-largest K-12 school upgrade FSG had ever completed," Malave said.

The work was done primarily throughout the summer months as well as after school hours to minimize disruptions to the district's operations. "The installation was smooth," confirmed Malave, noting that FSG team members did much of the installation themselves but chose to work with IBEW Local 400 contractors in two of the schools.

"We worked hard to get the right product to each job in the right quantities each day," said Malave, adding that in one instance FSG even sent out its own service technicians to fix an exterior lighting fixture in need of repair to ease the burden on the school's maintenance team and ensure a single point of contact.

A Lesson in Great Lighting

Since completing its extensive upgrade, the school system couldn't be happier with the results. In ad-

The DOE Evaluates LED Industrial Luminaires

A new method for quantifying visibility of temporal light artifacts and recommending application-based limits is available.

PHOTOMETRIC FLICKER—the modulation of light source intensity or output over time—is an old lighting issue that diminished with the mass adoption of fluorescent electronic ballasts but has returned with the advent of LED sources.

Flicker may be external or internal to the lighting system. It may be visible (present in an immobile light source observed by an immobile observer) or stroboscopic (visible or invisible, and perceptible if the light source or observer is in motion). And its effects range from irritating to impairment, in some cases even if it is not perceptible by users. Studied have linked it to eyestrain, blurred vision, and impaired performance. A small percentage of people are particularly susceptible and may suffer headaches and migraines. Flicker may also be problematic for videoconference applications, which use cameras.

The problem with LEDs is that, unlike traditional sources, they have no persistence. This means changes in forward current result in a nearly instant change in light output, potentially making flicker more pronounced.

Dimming LEDs is particularly concerning. Phase-control dimmers, which chop the AC waveform to produce dimming, may cause LEDs to rapidly cycle and produce flicker. If flicker is present, dimming may also make it more visibly pronounced, as flicker is more noticeable at lower light levels.

Generally, LED products featuring high-quality drivers that are properly paired with compatible controls will not produce objectionable flicker. These drivers are typically larger and more costly, however. In particular, digital controls generally do not induce flicker in the LED lighting system. So to minimize flicker, the electrical installation should minimize potential for electrical noise (external cause), feature LED products with high-quality drivers, and feature dimming controls that are either digital or confirmed as compatible with the LED product. For maximum assurance, a test installation may be beneficial. (Flicker can be measured in the field using specially designed handheld meters.)

Due to the importance of this issue, the lighting industry required metrics and guidelines to help electrical professionals evaluate and specify appropriate products. In 2015, the IEEE published *IEEE PAR1789-2015*, provid-

dition to reducing the district's energy consumption by more than 2 million kWh per year and slashing its utility bills by more than $150,000 each month, "The lighting quality has definitely improved and has a more consistent color, and the schools won't have to juggle lamps of different ages and brands any longer," said Malave.

Lagravenis agreed. Compared with the performance of the fluorescent lamps, which diminished in light output and color over time, "Our new LEDs look brighter and the lighting quality is excellent," he said. "We were able to reduce wattage significantly, which is delivering outstanding cost savings."

Lagravenis also heaped praise on FSG. "Working with us to oversee a one- to two-year-long project across six different buildings is very difficult, but FSG was extremely professional, and worked very clean—delivering a big savings to us—and was great on follow-up," he explained. "We held a contractor's meeting every two weeks and they were always there, prompt and vocal, to help us get through a sizable project in a short window.

"Our team spent a lot of time in the past changing lights, but our upgrade will save a lot of labor time that I can now put toward other uses," he continued. "I'm thrilled that I get to use our crew members' time more wisely now."

For Malave, the project represented an essay in great teamwork. "The school district was extremely helpful, accommodating, and flexible; communications were great and we were able to work together very proactively," he said. Additionally, as a native of the area, he felt proud to have helped the school district put its best foot forward. "I love that I get to do this work in the area where I grew up," Malave said. "It's great to know that I'm making a difference in my local market." ■

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ing recommendations for minimizing flicker based on existing flicker metrics. These recommendations can be summarized as three major application needs: prevent seizures among light-sensitive people, limit other biological effects, and prevent these other effects. For each, the IEEE recommends maximum percent flicker based on frequency.

After the IEEE published its recommendations, NEMA released a position paper stating that the IEEE recommendation is overly stringent for many applications, which could result in unnecessary additional cost to products due to more robust electronics required. In April, NEMA published *NEMA 77-2017*, a new standard recommending a method for quantifying visibility of temporal light artifacts such as flicker and recommending application-based limits. The measurement methods and recommendations are applicable to all types of lighting (lamps, luminaires, etc.) and controls, although control methods and recommendations are limited to phase-cut dimming. It addresses visibility among human observers with limited speeds of motion, but does not address interference with equipment such as cameras or stroboscopic flicker.

Standards provide manufacturers a basis for testing and reporting and electrical professionals a basis for product evaluation, comparison, and application. Recommendations give electrical professionals guidance to properly select products. This is important to the industry because if a lighting installation suffers from objectionable flicker, and that flicker is part of the LED product's normal operation, typically the only recourse is product replacement. For this reason, distributors should vet LED products as posing a low risk of producing flicker before commitment. New methods and recommendations provide valuable tools to facilitate this vetting. ■

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