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A Lesson In LED Adoption: Understanding the hurdles faced by K–12 schools

As of 2020, approximately 78% of lighting in U.S. educational buildings was fluorescent, according to data collected by the U.S. Department of Energy Solid-State Lighting Program. This spurred a journey to understand why schools have the lowest adoption of LED lighting among all commercial building types. During the Pacific Northwest National Laboratory's (PNNL's) initial conversations with school facility managers and other lighting professionals, the reasons became clearer. What follows is a synopsis of what has been uncovered so far, yet there remains much to learn. These stories are anecdotal; they represent real experiences, decisions and concerns from nine K–12 school districts in seven states, coast to coast.

For a moment, imagine you are a facility director who is responsible for maintaining three school buildings in rural America. You have relied on linear fluorescent technology for over 20 years. When your lamps fail, you're fine; you simply replace them at the local hardware store. They are easy to replace, and you know what to expect in terms of light output, lifetime and maintenance.

Now step into the shoes of the director of Environmental Services at a mid-sized school district, where you have been working for the last 30 years. You have performed lighting upgrades on a continuing basis, as the budget allows. Upgrading to LEDs easily meets the district's energy reduction goals, and the utility offers worthy incentives. Over time, this has led to a variety of luminaires and controls in your 20 schools: a base of fluorescent, some TLEDs, and a smattering of LED fixtures. But, in 2015, an architect selected sophisticated LED fixtures and controls that you have been struggling to maintain ever since installation, which means as the proprietary controls fail, you switch them out for something manual wherever you can.

In another district, the year has proven to be challenging. Unprecedented tension between teachers and administration impacted operations for weeks, and then there was a winter storm that caused fallen trees, power outages and burst pipes. Fortunately, the lighting system is operational, so it doesn't have to be your primary concern. Additionally, the school board (and parents) want all buildings upgraded at the same time. There is a state-wide ban on fluorescent lamps looming, but right now you are just surviving from day-to-day; that worry will have to wait for another day. The worst-case scenario is that you'll still be able to buy lamps in a neighboring state.

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Photos: PNNL

Installers placing LED fixtures in a classroom have their questions addressed by a manufacturer's representative on the phone.

Now switch gears again, and imagine you're the energy manager at a district with more than 25,000 students across 70 school buildings. The local utility has stopped offering lighting rebates. You've upgraded a couple of elementary schools to 100% LED, and teachers love the ability to dim; however, with the number and size of the other buildings you maintain, you just can't prioritize lighting, especially with a backlog of maintenance work and a lost lighting system password that already cost $500. This year, you requested an operating budget of $900,000 and received $350,000, so even with extremely generous rebates, an upgrade would be hard to justify. You have a job posting for an electrician, but it's been over a year with no qualified applicants.

From the perspective of facility personnel, fluorescents have met the basic needs of the school district for over four decades. It's easy—no need to worry about types or manufacturers, lamps are readily available, and the cleaning staff can change them out as needed. With classrooms generally operating half as many hours as offices, the simple payback period associated with switching to LED is doubled.

Yet, changes are looming. The availability of fluorescent lamps and ballasts will shift as more statewide bans on linear fluorescent lamps go into effect. If manufacturers curtail production, fluorescent components are unlikely to remain as inexpensive as they are today. None of the school facility personnel seemed concerned with fluorescent lamp availability, even in the states with imminent bans.

How many people does it take to change a light bulb? The answer is no joke for schools with limited staff: one—with a few minutes time, and no certification or training necessary. On the other hand, with integrated LED troffer offerings, maintenance staff often don't know what to do when a fixture stops working.

Upgrading to LEDs often requires a licensed electrician for installation and knowledge of existing conditions. If the school has asbestos behind the ceiling, replacing luminaires is usually not viable. If the existing fixture housings are in good condition, the go-to upgrade is the TLED. Depending on the type of TLED, the school needs to know if its fixture has shunted or non-shunted sockets, and the type of existing fluorescent ballast and whether it's compatible with the new TLEDs. In the situation where a school has replaced its ballasts over the years, the diversity of installed inventory makes compatibility a challenge.

For upgrades to happen, facilities personnel must be up to the task; the school board must provide enough funding and electricians need to be available. And then after all the effort, fingers are crossed that staff, students and parents do not complain about the changes. Considering all these factors, it is perhaps less surprising that so many school buildings have not made the switch to LED technology.

As existing lamps and luminaires fail in schools over the next 10 years, what replacement options will be available? Some manufacturers are slowing or halting production of fluorescent fixtures and ballasts, so when TLEDs fail and the old fluorescent housing needs be replaced, is the solution to switch to fixtures with integrated LEDs? Energy savings and utility rebates subsidized many of the initial upgrades, so without a subsidy, it is likely facility managers will choose the lower-cost options found online or at the nearest big-box store.

TLED maintenance challenges recently hit home here at PNNL. A TLED over-heated and then dangled from the fixture after a well-trained technician made an understandable mistake installing the wrong TLED type. It is easy to imagine this happening as more TLEDs are installed, and this may lead end users to look for other options.

Lighting in schools impacts many of us on a personal level, from kids learning in schools, to family and friends working in schools. According to International WELL Building Institute, more than ⅛ of the U.S. population spends time in a K–12 school building each weekday.[1]

We know that LED technology can provide effective lighting, reduce energy consumption and save taxpayer dollars. There are technology solutions to the challenges schools face, but as one facility manager with 100% LEDs in his 60 schools stated, "Schools will suffer with sophistication."

Understanding the hurdles faced by K–12 schools, and how they differ from other sectors, makes it easy to see why schools are not broadly embracing LED technology. Stay tuned as we continue to hear from the boots on the ground.

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References:

1 21st Century School Fund, Inc., International WELL Building Institute and the National Council on School Facilities. *2021 State of Our Schools: America's PK–12 Public School Facilities*. Available: *https://resources.wellcertified.com/tools/2021-state-of-our-schools-report/*