

## Technology Brief: LED Warehouse Lighting

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Report # ET11SMUD1019

### Introduction

During the past five years, steady improvements in LED lighting technology have opened the door to some exciting new opportunities to save energy.

At this point LEDs have become a viable option for many outdoor lighting applications (as evidenced by numerous case studies and reports). Screw in LED replacement lamps and LED lighting for refrigerated food cases are also rapidly gaining momentum. The remaining new frontier for LED lighting technology is applications that are currently dominated by linear fluorescents.

Modern T8 fluorescent lamps provide a very energy efficient, cost effective option for almost every indoor lighting application. Recent improvements in ballasts and lamps have yielded T8 lamps with rated life spans of up to 62,000 hours (e.g. OSRAM Sylvania). Obviously, LEDs are up against some very tough competition in this market. Yet even now, some opportunities exist for LEDs.

From 2010 to 2011, SMUD worked with the AmerisourceBergen Drug Company to test LED technology in a warehouse application. This technology brief focuses on the results of our field research.

### Background Information

AmerisourceBergen is one of the world's largest pharmaceutical service companies serving the United States, Canada and selected global markets with a focus on the pharmaceutical supply channel. The company provides drug distribution and related services to pharmaceutical manufacturers and healthcare providers.

AmerisourceBergen has 26 pharmaceutical distribution centers and three specialty distribution centers strategically located throughout the United States. Nine distribution centers are in Canada.

The Sacramento facility includes a sprawling 285,000 square foot product distribution center. Product

orders are filled through a combination of automated conveyor belts / packaging systems, as well as manually by AmerisourceBergen employees. Since the facility is so vast, employees ride around on electric carts and select products from hundreds of racks. The racks are organized into sections called pickfingers.

The original lighting system in the pickfingers consisted of eight foot T8 fluorescent fixtures (Figure1). The lights were controlled by a centralized lighting panel and operated 24 hours per day except on Saturdays (6,800 hours per year). Each lighting fixture consumed around 110 Watts of power.

Employees do not typically linger for more than a few moments within any area of the pickfingers; they move from one section to another choosing products and loading them into baskets. Because of this, periods of time exist with little to no activity in some areas while other areas are very active.

AmerisourceBergen's Engineering Staff considered using motion sensors to save energy, but were concerned about negatively affecting the life of the fluorescent lamps. Although fluorescent lighting offers many advantages, frequent switching dramatically reduces lamp life, so controlling the lights with sensors was not a viable option.

The new LED lighting system includes Albeo Technology's 8 foot C-Series<sup>TM</sup> light fixtures (Figure 2).



Figure 1: The original lighting system included hundreds of fluorescent fixtures. Photo credit: SMUD



Figure 2: New LED lighting system. Photo credit: SMUD

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Each of the Albeo fixtures is controlled by a motion sensor mounted to the end of the fixture. The eight foot C-Series fixture (Figure 3) used in this project has the following characteristics:

- 4725 lumens
- 5000K CCT
- 72 Watts
- 60 LEDs / fixture
- Efficacy: 71 LPW
- “Aisle” optical light distribution (14° beam spread)
- Life expectancy: 50,000 hours\*



Figure 3: The Albeo C-Series LED fixture offers several different optical distribution patterns. Photo credit: [www.Albeotech.com](http://www.Albeotech.com)

\*Note: unlike fluorescent lamps, the rated life for LEDs is not based upon predicted failures; it is when the LEDs are expected to lose 30% of their output. This is known as the L<sup>70</sup> life.

### Project Results

- Good illumination levels: especially for the products on the lower shelves of the racks
- Energy savings: 284,897 kWh per year (74%)
- Demand reduction: 29.9 kW (53%)
- Estimated utility bill savings: \$29,745 / year
- Project costs: \$175,000
- SMUD research grant: \$65,000
- Net project cost: \$110,000
- Simple payback: 5.9 years\*

The simple payback calculation shown here is based upon utility bill savings only: it does not include maintenance savings.

### Lessons Learned

In terms of efficacy (LPW), the new LED fixtures are not much more energy efficient than the original T8 fixtures. However, the precise light distribution patterns of the LED fixture provided an opportunity to reduce the overall number of lighting fixtures.

The second major source of energy savings came from the use of occupancy sensors. Unlike fluorescent lamps, LEDs are not negatively impacted by frequent switching. To maximize energy savings, the project team wanted to set the time delay of the sensors to five minutes. Easier said than done!

- Since most sensors are geared towards fluorescents, the minimum time delay setting for many products was ten minutes. Given the movement patterns of the warehouse employees, setting the timer for ten minutes would seriously impact the amount of savings.



Figure 4: Finding a motion sensor with the right coverage patterns and minimum delay settings was a real challenge. Photo credit: SMUD

- The second major challenge was finding sensors that had the right coverage patterns (Figure 4). Many sensors that are marketed for aisleway applications are designed for higher mounting heights (the fixtures at AmerisourceBergen were suspended at twelve feet above the floor).

After exhaustive testing of many different products, the project team was ready to give up. That's when Leviton offered to custom program their sensors to meet AmerisourceBergen's requirements. Overall the Leviton sensors work very well, but are sometimes falsely triggered by movement of products on conveyor belts.

### Next Steps

SMUD wishes to thank AmerisourceBergen for helping us test LED lighting. Because of successful projects like this one, SMUD now offers customized energy efficiency incentives for LED fixtures that have been approved by Energy Star or the Design Lights Consortium (DLC). For more information, please call SMUD Commercial Services at 1-877-622-7683 or visit [www.smud.org](http://www.smud.org).

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