

## LED LIGHTING IN FREEZER CASES

Demonstration and Evaluation of Lighting Technologies and Applications ▲ Lighting Case Studies

Supermarket freezers use interior case lighting to make products visible and to capture the attention of shoppers. Illuminances on the products must be higher than outside the freezer case to minimize the distraction of veiling reflections on glass doors. At the same time, the lighting should minimize heat to reduce cooling load and prevent food spoilage.

Typically, fluorescent lamps are mounted vertically along the backside edge of the glass doors. However, in cold temperatures, fluorescent lamps suffer from decreased light output and reduced lamp life. Fluorescent lamps also produce diffuse light in all directions; therefore, some portion of the light does not illuminate the products effectively. Also, since some cases minimize space between doors and shelves, light distribution may be concentrated near the lamp rather than spreading uniformly across the merchandise.

The use of white LEDs can improve light distribution and increase customer preference. LEDs have the potential to reduce maintenance costs over time because of their longer life as compared to fluorescent lamps. LEDs now offer an energy-efficient advantage over fluorescent lighting in freezer applications.

### Application Profile

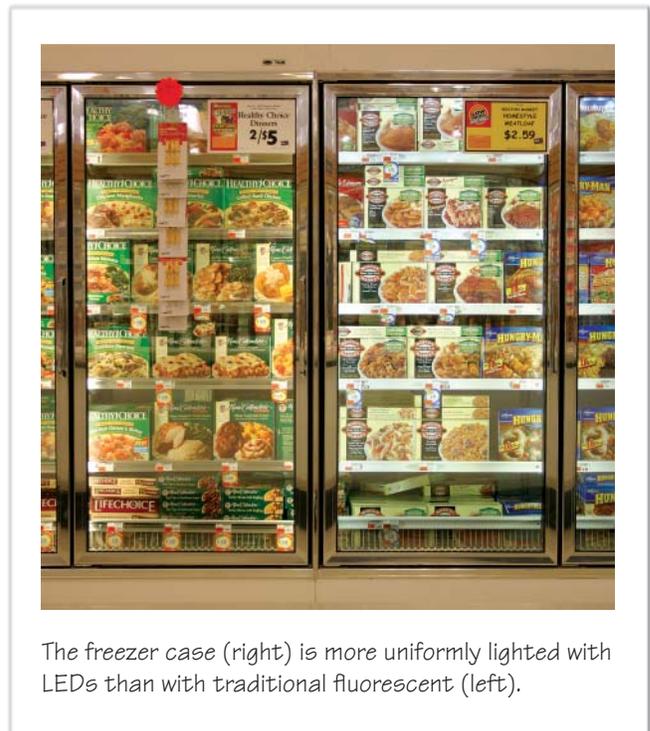
Price Chopper is a chain of 115 supermarkets located throughout New York State and greater New England.

At a Price Chopper store in Rotterdam, N.Y., the Lighting Research Center evaluated a freezer case with prototype LED lighting side-by-side with a freezer case with standard T8 fluorescent lamps. Several LED conditions were tested, including full output and dimmed to approximately 80% output.<sup>1</sup>

<sup>1</sup> For more information, see [www.lrc.rpi.edu/programs/solidstate](http://www.lrc.rpi.edu/programs/solidstate)



White LEDs were mounted vertically and aimed to graze the front of the shelves.



The freezer case (right) is more uniformly lighted with LEDs than with traditional fluorescent (left).

### Objectives

- Improve illuminance uniformity in freezer cases
- Evaluate shopper preferences
- Monitor product sales
- Compare LED energy use to traditional fluorescent in this application
- Demonstrate an application for this new lighting technology

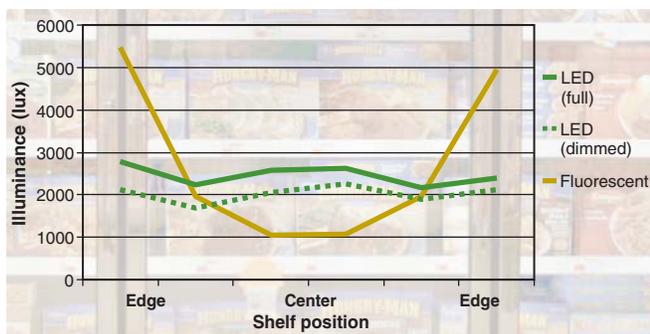
### Lighting System

A new, four-door freezer case was installed with prototype LED luminaires in place of traditional linear fluorescent luminaires. The new case uses high output white LEDs (5500 K) mounted vertically at 1" (2.5 cm) spacing (see photo, left). An additional line of LEDs is mounted horizontally at 2" (5 cm) spacing along the top of the case, behind the door header. The LEDs graze the front of the shelves. For comparison, a new four-door case with traditional fluorescent lighting was installed adjacent to the LED case. The fluorescent system uses five-foot (1.5 m) T8 fluorescent lamps (80 CRI, 58 W, 3500 K).

## Illuminance

On average, illuminance levels were slightly higher with fluorescent than with the new LED system; however, uniformity was higher with the LED system (see graph below). In the fluorescent freezer case, the centers of the shelves were noticeably darker than the sides.<sup>2</sup>

**Average Vertical Illuminances on Shelves**  
Six shelves per door, four doors per freezer case



**Illuminance uniformity is improved across the front of the merchandise with the LED system.**

## Energy Outlook

LEDs can now save energy over fluorescent lighting in freezer cases (see graph at right). At full power, this 2003 prototype LED system used 652 W for a 4-door case.<sup>3</sup> Using 2006 LED technology, the case would draw 362 W at full output.<sup>4</sup> When dimmed as shown in this field study, total wattage would be 276 W. This compares favorably to the wattage of the fluorescent system in this study, which uses 290 W. As the efficacy of white LEDs increases, this technology will be even more competitive with traditional fluorescent in freezer case applications, both on the basis of improved preference and reduced power for equivalent illuminance. Several LED products are already commercially available for supermarket freezers, and many retailers are testing their own LED systems.

<sup>2</sup> Compared to the demonstration cases, existing freezer cases in the store have more space between lighting and shelves. This produces illuminances that are lower and more uniform.

<sup>3</sup> Using 2003 white LEDs from Lumileds

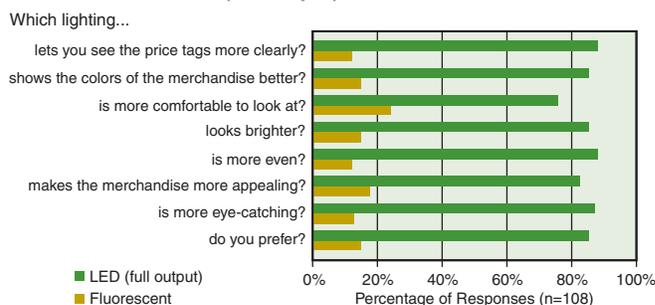
<sup>4</sup> Nominally rated at 45 lm/W in 2006, compared to 25 lm/W in 2003

## Shopper Survey

Shoppers overwhelmingly preferred the LED freezer case lighting for displaying packaged foods of many different colors (see graph below). Even when dimmed to approximately 80% of full output, shoppers expressed a strong preference for the LED system.

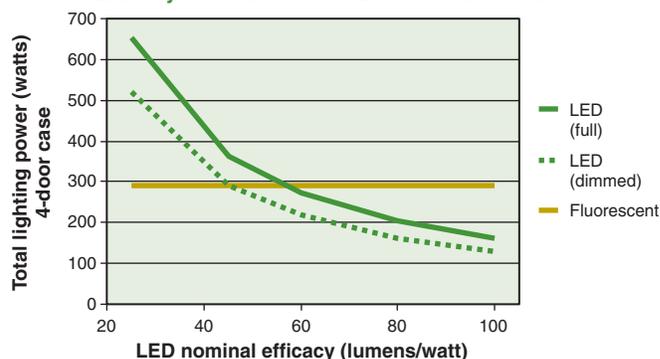
This did not translate into increased sales. Sales volume did not change when products were lighted with LEDs compared to fluorescent lamps.

**Shopper Survey**  
LEDs (full output) vs. Fluorescent



**Shoppers preferred the LED system to the fluorescent system.**

**LED vs. Fluorescent Freezer Lighting**  
Efficacy vs. Power for the Demonstration Cases



**As LED efficacy increases, the energy use of LEDs will compete with fluorescent in freezer applications.**

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LED Lighting in Freezer Cases

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Field Test DELTA evaluates new energy-efficient lighting products to independently verify field performance claims and to suggest improvements. A primary goal of the Field Test DELTA program is to facilitate rapid market acceptance of innovative energy-efficient technologies.

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