

Energy-Efficient Lighting Alternative for Commercial Refrigeration

Supermarkets spend nearly half of their electricity costs to operate refrigerators and freezer cases. One quarter of the electricity required to run these cases goes to lighting the interiors, generally with fluorescent lighting. However, cold temperatures can decrease the light output and reduce operating life of fluorescent lamps. The light distribution from fluorescent lamps in this application can also be poor because of a lack of optics to direct the light and poor configuration and mounting within the case.



The photo shows the test fluorescent-lighted freezer on the left, and the LED-lighted freezer on the right. The LED-lighted freezer showed better light uniformity across the width of the shelves, leading to better ratings from shoppers.

Field Study

Building on a previous lab study, the LRC worked with LED and refrigeration manufacturers to develop a prototype LED freezer lighting system and to conduct a field study at an Albany, N.Y., area supermarket. The study evaluated the effectiveness of LED lighting systems in commercial freezers.

Researchers installed two identical, four-door freezers—one with an LED lighting system; another with traditional fluorescent lighting. The goals of this study were to:

- Improve light uniformity and visibility of merchandise
- Evaluate shoppers' lighting preferences
- Demonstrate the benefits of LED lighting technology
- Compare the energy usage of LEDs with traditional fluorescent lighting technology in this application
- Monitor product sales under new and traditional lighting

Over 18 months, the LRC conducted human factors and energy-use evaluations.

Product Sales Analysis

Sales from each freezer over 18 months were compared with a control store. A statistical test showed no significant change due to the lighting.

Sponsors

New York State Energy Research and Development Authority, GELcore, Price Chopper, Tyler Refrigeration

LRC Solid-State Lighting Program

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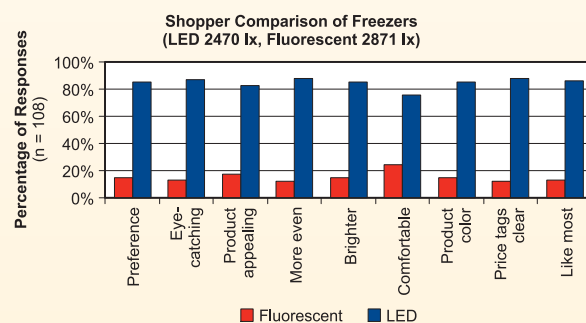


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Lighting
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Shopper Survey

Shoppers' opinions were collected about the appearance of the merchandise, and the overall brightness, comfort, and evenness of the lighting. The survey clearly demonstrated that shoppers preferred the LED-lighted freezer, even when the lighting was dimmed to an illuminance level 25% lower than that of the fluorescent-lighted freezer. The better uniformity and higher CCT of the LED lighting likely contributed to the positive results.



Energy Usage Comparison

Although the LEDs used in this study (year 2003) did not provide an energy savings over fluorescent lighting, as of 2006 LEDs can match the energy use of fluorescent at an acceptable light level.