

Energy Consumption and Product Throughput of Glass-Doored and Open Refrigerated Display Cases in Supermarkets

Brian A. Fricke, Ph.D. and Bryan R. Becker, Ph.D.

Mechanical Engineering
University of Missouri – Kansas City

Refrigerated display cases are utilized by supermarkets to store and display food products in a manner that extends food shelf life and ensures food safety. Supermarkets operate their refrigeration systems continuously to maintain proper food storage conditions. Continual operation of this refrigeration equipment on a nationwide scale accounts for approximately 0.33 quads/yr of electrical energy. Infiltration accounts for over 70% of the refrigeration load in open refrigerated display cases. Clearly, an increase in the energy efficiency of refrigerated display cases will result in significantly reduced energy consumption and cost.

Thus, the objective of this project is to compare a typical open refrigerated display case to a typical glass-doored refrigerated display case with the aim of quantifying the following:

- The difference in overall energy consumption between the cases.
- The normalized difference in food product sales between the cases.

Two supermarkets are being used as test sites, which are similarly situated to ensure that climate, weather, time-of-year and economic conditions of the shoppers are comparable. One supermarket will receive an open refrigerated display case and the other will receive a doored refrigerated display case. Each refrigerated display case will be a medium temperature, self-service prepackaged deli or beverage case between 8 and 25 nominal linear feet.

The thermal performance and product sales of each refrigerated display case will be monitored. Automated data logging systems will be used to measure quantities such as refrigeration load, voltage, current, temperature, humidity and pressure. Product sales for each refrigerated display case and total store product sales will be tracked using Stock Keeping Units (SKUs) and the supermarkets' computerized Point of Sale (POS) system. The resulting data will be analyzed to determine the difference in energy consumption and product sales between the two refrigerated cases.