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Paul Adams

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ENERGY MANAGEMENT IN THE FOOD STORE

Paul Adams P.E.
Hussmann Refrigerator Co.

Food store refrigeration is vital to the food distribution system and consumes much of the energy used in a supermarket. The manufacturers of food store display equipment have worked long and hard to develop new ideas in supermarket energy conservation. Hussmann's studies have uncovered a number of facts invaluable to anyone concerned with energy conservation in the supermarket.

The first fact is to realize that supermarkets are different from any other retail stores. They consume more energy each year per sq. ft. of store - or per customer - or per dollar sales than other retail stores and most commercial businesses.

Supermarkets are the only retail stores in which much of the merchandise is refrigerated. In a large supermarket, the equivalent of 40 tons of air conditioning is continually mixed into the store's environment, 24 hours a day, 365 days a year.

The human factor in supermarkets is unique also. Everyone is continually on the move. Only the checkers stay in one place, but work at a rapid pace. Customers are moving about dressed for the outside environment. Therefore, heating and air conditioning is not designed in the same manner you would for an office building.

Some stores are run as low as 65° in the winter. Unlike other business establishments, supermarkets use less energy as the store environment is lowered in temperature and humidity.

According to industry figures, refrigeration equipment accounts for 1/2 of 1% of the total food store investment over the life of the store. Consequently, up until the energy crisis of 1973, refrigeration equipment was not a real matter of concern to the people who used it, even though it was "the tool of their trade." However, once energy costs approached the rental charges, refrigeration energy requirements began to receive the attention of top management. Today, energy conservation is the most important single subject in food retailing.

In order to better understand the various areas of supermarket energy use, Hussmann has been conducting a series of in-store tests at Tom Tarpy's Market in Columbus, Ohio. This store has a completely integrated heating, air conditioning and refrigeration system. It is continually monitored at 130 strategic locations. Data points include number of customers, door openings, atmospheric conditions, store environmental changes, refrigeration requirements and recording watt hour meters in addition to the main watt hour meter provided by the local utility company. We have refrigerant flow meters measuring all liquid refrigerant flow to refrigeration and air conditioning, as well as devices to record continuously the pressure differential between the supermarket interior and exterior. Many of these tests have been designed in conjunction with the Mechanical Engineering Department of Ohio State University which has conducted extensive tests in other commercial buildings. Other tests at Tarpy's include a full weather station to record ambient weather conditions.

All the information gathered at Tarpy's is stored in a computer and sent to Hussmann for analyzing. We can change store conditions and study the effects on the rest of the store's environment.

Our long range goal for these tests is to develop a program whereby, using the test data, we can provide our customers with a total annual energy estimate for use in their store design process. Using this estimate, they can adjust store construction and equipment to create the lowest possible energy requirements. Based on what we have accomplished to date, we can predict consumption within 10% and we hope to get that figure down to 5%.

Now let's turn to some energy saving facts we have gathered. Reclaiming the heat of rejection from the refrigeration compressors to heat the store is the simplest money saver available to the supermarket operator. It is accomplished by diverting hot gas from the refrigeration compressors into a coil installed in the air conditioning system. In the test store, heat reclaim replaced electric

resistance heat, saving \$6,197 during the winter of 73-74. The store owner realized a 12% savings on his annual power bill simply by using this otherwise discarded heat of rejection.

Another proven energy saver has been night setback. Turning the store temperature down at night not only saves on heating, but also lowers refrigeration costs. As the store cools down, the load on the refrigeration decreases. Heat reclaim is required to make night setback effective to warm the store in the morning. Night setback works in summer and winter.

Air conditioning properly designed can use the cooling that spills from the cases to reduce air conditioning requirements.

In order to equalize distribution of cold air throughout the store, we have designed a network of return air ducts beneath open multi-deck cases to capture the cold air spill over and return it into the air conditioning system. In some cases, this "free air conditioning" can provide all the required cold air for the store.

In any case, it creates a more even environment for the store, reduces cold aisles in frozen food departments and helps equipment because the returned air is already dehumidified.

The amount of "free air conditioning" depends upon the size of the store and the type of refrigerators used.

Another area of savings is in anti-sweat heaters. These heaters represent 6% of an annual power bill but are not really needed when the store dew point is below 50° or equivalent to 40% relative humidity and 75°. Controls to turn off heaters when these conditions are met are now available.

Insulated night covers would seem to be a possible energy saver in the future. At night when the store is closed, these covers keep refrigeration inside the case and reduce the load on the refrigerator. However, without the proper type of refrigeration system, it is possible that the reduction in load can cause mechanical failure through short cycling or loss of oil. A controlled test at Tarpy's Market showed a potential of 8% annual savings with insulated night covers.

We began by stating that supermarkets are different from other retail establishments. Environmental criteria for other stores simply will not work for supermarkets. There is very little literature available on the food store environment, so owners are having to make their own way through the maze. Hopefully, this presentation will start you in the right direction.

Paul Adams, P.E.
Product Manager/Refrigeration
Hussmann Refrigerator Co.
Bridgeton, Mo.

B.S. Mechanical Engineering, Kansas State
University, Registered Professional Engineer

Twenty-one years experience in commercial
refrigeration, heating and air conditioning,
environmental control, meat and dairy handling
system.