

Case Note

Keeping food safe using ABB's energy management and automation expertise



The food distribution network in the United States that supplies grocery stores, restaurants and institutional facilities is among the most complex and precise of any mass market product category. Every step within the network has to be working flawlessly to assure that perishable food is delivered in fresh and stable form; this preserves the reputation of the purveyors and the safety of consumers.

One of the most sophisticated, but lesser known, players in perishable food distribution are public cold storage (PCS) warehouses that rent space to food manufacturers for varying lengths of time. Many large food manufacturers have their own "private" cold storage facilities, but use public facilities for regional storage -- or for additional space during peak periods; examples include seasonal storage for hot dog buns or ice cream, leading up to the Fourth of July.

Interstate Cold Storage (ICS) ranks among the largest 25 public cold storage warehousing companies in North America, with five locations in Indiana and Ohio, and nearly 22,000,000 cubic feet of total refrigerated space. The company's facilities store products at temperatures that range from -20° F to 62° F, and ICS's many clients include Edy's Grand Ice Cream, Rich Products Corp, and the Ohio School Lunch Program.

For the company's modernization analysis, they utilized the 22-year-old, 5.5 million cubic foot Ft. Wayne West facility as a test case, to assess the potential energy savings and operational improvements that could be achieved by upgrading the refrigeration infrastructure.

Challenge

- Decrease operational costs while maintaining plant efficiency
- Manage the constant rotation of different foods requiring a wide variety of holding temperatures and different speeds at which they are to be frozen and tempered (thawed)
- Control electricity consumption

Solution

26 ABB VFDs were added to the motors powering the compressors, evaporators and condensers (the primary components of the entire refrigeration system).

Benefits

Most striking was the savings in energy costs, as the Ft. Wayne West facility immediately realized an electrical energy consumption savings of 35%, providing a six-month return on the up-front investment of the drives.

The major sources of the energy savings include:

– **Compressor Capacity Control**

Before the installation of the drives, the only way to control the capacity of the compressor was through opening and closing the slide valve (discharge port), which allowed for non-linear, inefficient control of capacity. There was a lot of waste within this range. With the drives, the capacity can be set at any point between 0 to 100%, allowing for the use of the exact amount of energy needed at any given time, with no waste.

– **Condenser and Evaporator Fan Control**

Before the drives, the only setting on the condenser and evaporator fans was “on” and “off.” With the drives, the control of the condensers can be far more precise.

Based on these benefits, alone, ICS added drives to the refrigeration system in its remaining four locations; facilities that range in age from 10 to 35 years, and in refrigerated storage capacity from 1.75 to 7.25 million cubic feet.

“The improvement in efficiency was clearly evident within a few months,” said Vince Tippmann, Jr., ICS president. “The dramatic reduction in energy costs made modernizing our other facilities in the same manner a top priority.”

The benefits of the drives were not confined to energy savings, alone; several major operational improvements also were realized:

– **Cooling and Tempering**

VFDs help provide more precise control over the speed at which a product is cooled or thawed. For ultimate quality, different products need to be cooled and thawed at differing rate - loaves of bread, for example, to be frozen quickly but thawed slowly. Pork needs to be tempered at a more controlled rate. The drives provide this ability more easily and more precisely, and, where necessary, have allowed ICS to offer freezing and tempering times that are 350% better than typical PCSs; this allows far quicker export rates and more flexibility for customers

– **Centralized Control**

A very sophisticated control system was installed with the drives, allowing the entire refrigeration system for the facility to be controlled and monitored from one centralized interface.

– **Extended Life/Reduced Maintenance**

The drives help ensure that the various motors are running only at the load necessary at any given time, extending the life and reducing the maintenance and repair needs the motors and the refrigeration equipment.

“Any cold storage- or refrigeration-based facility will be able to see energy savings very close to the 35% figure ICS realized via adding VFDs to the prominent components of their refrigeration infrastructure,” said Black. “They also should expect an array of intangible operational improvements.”

Refrigeration VFD Summary for a Typical 5.5 Million Cubic Foot (150,000 sq ft) Cold Storage Warehouse

System Component	Function	Statistics	ABB VFD Model
Compressors	Compress ammonia vapor. The highest HP load in the facility. Responsible for controlling the facility refrigeration capacity	Typically four, 2-stage compressors, each with two drives	ACS550; 200 hp to 500 hp
Evaporators	Evaporate liquid ammonia to remove heat from an area	Up to 20 VFDs, with one drive per fan group (3 to 6 fans per group)	ACS350 and ACS355; 10 hp
Condensers	Rejects heat from ammonia into the atmosphere	Four to eight VFDs on multiple fans (servicing multiple coils)	ACS550; 20 hp

For more information, please contact:

ABB Inc

Low Voltage Drives
 New Berlin, WI USA
 Phone: 800-752-0696
 Fax: 262-785-0397

www.abb.us/drives

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