Oregon Freeze Dry

The Project

Oregon's Willamette Valley with its mild climate, 40 inches of annual rainfall and fertile soil is one of the largest food production centers in the nation. It was the perfect home in 1963 for a small firm that processed dried fruit for breakfast cereals. Over the years, the firm developed military rations and private-label food brands. It also perfected the freeze-drying process that combines the freshness, color, and aroma of frozen foods with the shelf stability and convenience of canned and dehydrated foods. Today, Oregon Freeze Dry, Inc. in Albany is the largest custom processor of freeze-dried products in the world and a technological leader in the freeze-drying process.

Oregon Freeze Dry has three manufacturing plants on its 35-acre site. Its manufacturing process is energy-intensive, especially the two-stage ammonia-based industrial refrigeration system that serves 14 freeze-dry chambers and several cold rooms.

The company's engineering staff initiated a study, with help from Pacific Power and an energy-engineering firm. The study revealed several energy-saving opportunities that the company implemented.

In March 2003, Oregon Freeze Dry completed installation of variable-frequency drives (VFDs) on each of four screw compressors of its refrigeration system. These allow the compressor motors to vary speed to match refrigeration loads. The company also replaced an undersized 8-inch suction line with a 12-inch line. The energy savings of the VFD and suction line were substantial—nearly 2 million kilowatt-hours annually or 34% of the refrigeration system's base energy use. In addition, the VFDs require minimal employee training and reduce motor and compressor wear.

PROJECT SUMMARY

Benefits

- Reduced energy use
- Less wear of equipment
- Minimal employee training
- Improved system control

Financial Overview

Incremental Installation Cost
$241,777

Oregon Business Energy Tax Credit
$81,535

Pacific Power Incentive
$115,042

Energy Savings
34% of base energy use
1,939, 000 kWh/year

Energy Demand Savings
160 kW/month (results are highly variable)

Energy Cost Savings
$77,700/year

Resources

Project Owner
Oregon Freeze Dry, Inc.
(541) 926-6001
www.ofd.com

Energy Consultant
Cascade Energy Engineering, Inc.
(503) 287-8488
Rob Morton, P.E.
rob.morton@cascadeenergy.com

Business Energy Tax Credit
Oregon Department of Energy
1-800-221-8035 (inside Oregon)
(503) 378-4040
www.energy.state.or.us

Electric Utility
Pacific Power (For Oregon customers, incentives are now available through the Energy Trust of Oregon)
Inside Oregon: 1 (866) 368-7878,
www.energytrust.org
Outside Oregon: 1 (800) 222-4335
energy.expert@pacificorp.com

Background

The engineering staff at Oregon Freeze Dry believes plant energy use is their responsibility. In 2002, they decided to look at the ammonia-based refrigeration system, one of their most energy-intensive systems. They invited Al Leake of Pacific Power to discuss energy-efficiency projects and available incentives.

Pacific Power arranged for Cascade Energy Engineering to perform an energy study to find specific ways to improve the efficiency of the refrigeration system. Their report suggested three efficiency measures: 1) installing variable-frequency drives (VFDs) on four of the eight compressors; 2) adding a new suction line between two plants, and 3) expanding computer controls to manage the VFDs.

The existing compressors inefficiently varied capacity with slide valves. The VFDs would instead allow the compressor motors to vary speed to match refrigeration loads. The existing undersized suction line created a large pressure drop which required a lower (and less efficient) system suction pressure.

Oregon Freeze Dry management reviewed the report, found the financial payback and incentives attractive, and approved the installation.

Benefits

- VFDs and control system efficiently vary the capacity of the refrigeration system with speed control rather than with the less efficient slide valves.
- Energy savings of 1,939,000 kilowatt hours/year (34 percent of base energy use) with no reductions in production.
- Energy cost savings of $77,700/year.
- Reduced wear on motors and compressors due to soft starts and fewer operating hours.
- The VFDs and control system require minimal employee training.

Features

- ABB variable frequency drives were installed on four screw compressors (two high stage and two booster compressors). The remaining four compressors are now used for base loading and back-up.
- A Techni-Systems computer-control system manages which compressors run and at what speeds to meet the refrigeration load with maximum efficiency.
- A 12-inch-diameter suction line supplements the old 8-inch line.

Replication

- In industrial refrigeration systems, VFDs are often cost effective for screw compressors, evaporator fans, and condenser fans. Generally, VFDs are useful where equipment operates for long hours in systems with variable loads or light loads.
- If a compressor operates at or near full speed most of the time, adding an adjustable speed drive will not be cost effective.
- A VFD may not always be the best way to control capacity. Sequencing of multiple compressors or the use of a reciprocating compressor for trim are other possibilities.
- The use of VFDs is only one way to save energy in industrial refrigeration systems. Other ways include refrigeration computer control, thermosiphon oil cooling, high-speed energy efficiency doors, and bi-level lighting.