

CASE STUDY

BEST PRACTICES IN INDUSTRIAL REFRIGERATION

WestFarm Foods



The Project

WestFarm Foods is one of the largest dairy manufacturers in the nation, with 1,200 employees at 11 processing plants in Washington, Oregon, Idaho and California. In early 1996, WestFarm Foods began planning for an expansion and modernization of their Portland, Oregon creamery.

WestFarm engineers were designing a new Extended Shelf Life (ESL) processing line and the associated cooler space. Increased loads from the ESL process and cooler would require adding a 350-hp compressor to supplement the existing 350-hp and 600-hp screw compressors. This in turn would require another condenser.

WestFarm and their Portland General Electric account representative arranged for Cascade Energy Engineering to perform a detailed energy study, starting with data logging of the existing refrigeration system. The data collected included suction pressure, condensing pressure, and compressor slide valve position. Hour meters recorded run time for the liquid solenoid valves and power measurements were made on the primary refrigeration compressor.

Data logging revealed three major issues with the existing systems. First, compressors operated unloaded much of the time because they were sequenced manually, not by computer control, to meet the wide range of plant loads. Second, the high minimum condensing pressure of 140 psig, which was required to ensure proper liquid ammonia flow throughout the sprawling plant, resulted in increased compressor power, particularly during the winter. Third, the evaporator coil liquid solenoids in the milk cooler were off much of the time, resulting in excessive fan power.

PROJECT SUMMARY

Benefits

- Reduced energy cost
- Increased system capacity
- Improved control
- Improved trending and alarming
- Reduced evaporator fan noise
- Reduced condenser fan noise

Financial Overview

Incremental Installation Cost

\$310,000

Oregon Business Energy Tax Credit

\$108,000

Portland General Electric Incentive

\$127,000

Energy Savings

40% of base energy use
2,000,000 kWh/year

Energy Cost Savings

\$75,000/year

Resources

Project Owner

WestFarm Foods
(206) 281-3456
www.WestFarm.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

Portland General Electric (Incentives are now available through the Energy Trust of Oregon)
1 (866) 368-7878 (inside Oregon)
(503) 493-8888
www.energytrust.org

Efficiency Opportunities

A review of the baseline refrigeration bid specification revealed several opportunities to increase energy efficiency. First, the baseline design condensing temperature of 90°F would unnecessarily increase summer compressor energy use. Second, the heat rejection rate of the baseline condenser was a relatively inefficient 225 MBH/hp. Efficiencies of 300 MBH/hp or higher are possible. Third, the baseline design included neither computer control nor variable-frequency drives (VFDs).



Features

A computer control system was installed to provide improved compressor sequencing, tighter control of condenser fan set points, and more importantly, a “backbone” for VFD control.

A 350-hp VFD was installed on the new compressor, working in conjunction with its slide valve to provide load trim. The other compressors are now either off or at 100% capacity.

VFDs were used on the evaporator fans in the milk cooler and the new ESL cooler. The computer reduces fan speed whenever space temperature is satisfied.

A new high-pressure ammonia receiver with a booster pump was installed to ensure adequate liquid pressure to sensitive loads. This allowed the minimum condensing pressure to be reduced from 140 psig to 90 psig.

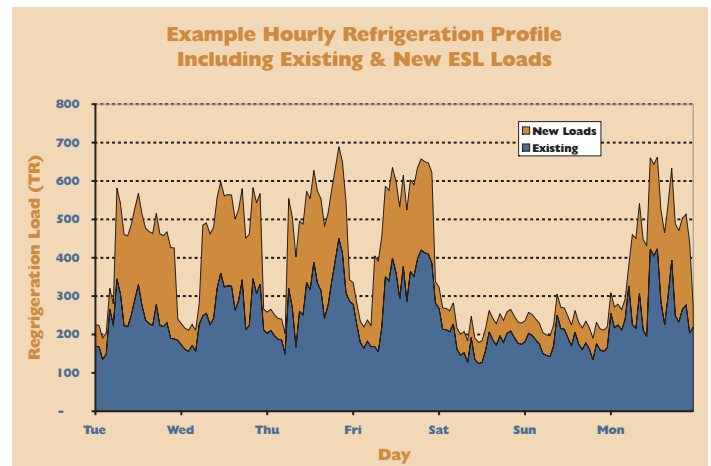
A larger, more efficient condenser was specified, and all condenser fans were equipped with VFD control to manage condenser capacity with speed rather than cycling.



Efficiency Measures

Implemented energy-efficiency measures include:

- Refrigeration computer control system
- Screw compressor VFD control
- Evaporator fan VFD control in ESL cooler
- Evaporator fan VFD control in milk cooler
- 90 psig condensing pressure
- Oversized/efficient evaporative condenser
- Condenser fan VFD control



Results

Implemented measures reduced annual energy consumption at the WestFarm facility by more than 2,000,000 kWh—nearly 40% of the total refrigeration energy use. Annual operating costs were reduced by about \$75,000.

The entire package of improvements cost \$310,000. Although this represented an attractive 4.2-year payback, incentives from Portland General Electric and a 35% tax credit from the Oregon Department of Energy reduced the final customer payback to one year.

