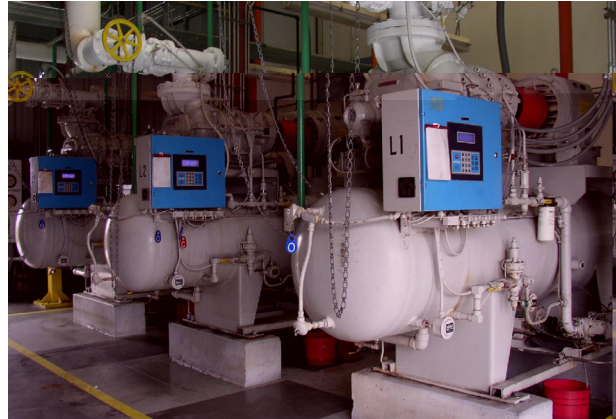


ENERGY SAVINGS FOR A FROZEN FOOD PROCESSING & COLD STORAGE PLANT

Background

This plant specializes in frozen vegetables and fruits processing and cold storage. The facility had an annual electrical energy consumption of over 10,000,000 kilowatt-hours (kWh) per year and an annual natural gas consumption of over 268,000 therms per year. The total energy costs were estimated to be approximately \$1.4 million each year.



Potential Energy Savings

The energy efficiency opportunities recommended could potentially save an estimated 1,508,095 kWh of electrical energy each year, or about 14% of the plant's total electrical energy usage. The recommendations could reduce the facility's electrical demand by about 200 kW. The recommendation could save an estimated 9,443 therms of natural gas each year, or 4% of the plant's total natural gas energy usage. The potential total annual cost savings due to implementing all of the recommended measures was estimated to be approximately \$488,000 per year. Total estimated implementation cost was about \$314,000 giving an average simple payback of 0.6 years.

SUMMARY OF ENERGY EFFICIENCY OPPORTUNITIES SAVINGS AND COSTS

Description	Potential Energy Conserved	Demand Savings (kW)	Potential Savings (\$/yr)	Implem. Cost (\$)	Simple Payback (years)
1 Shift Cold Storage Ammonia Compressors to Off-Peak During Summer	0 kWh/yr	325.34 ¹	31,170	0	Immediate
2 Replace Incandescent Lighting with Compact Fluorescent Lighting	3,690 kWh/yr	1.22	440	420	0.9
3 Control Main Hydraulic Pad Motors	15,003 kWh/yr	0.00	1,469	879	0.6
4 Install Occupancy Sensors Throughout Facility	25,611 kWh/yr	3.39	2,689	1,456	0.5
5 Replace Standard V-Belts with Cog-Type Belts	29,132 kWh/yr	3.92	2,884	2,389	0.8
6 Install Daylight Sensors in Various Areas Throughout Facility	20,206 kWh/yr	11.04	4,025	8,487	2.1
7 Install Condensate Return System	9,443 therms/yr	N/A	4,451	12,190	3.1
8 Install Adjustable Speed Drive on Evaporative Condenser Fans	131,844 kWh/yr	18.18	13,473	28,923	2.1
9 Install Oxygen Trim Control System on Steam Boiler	90,496 kWh/yr	10.33	10,276	37,490	3.6
10 Replace HID Lighting with High Intensity Fluorescent Lighting	255,491 kWh/yr	39.29	26,679	44,280	1.7

SUMMARY OF ENERGY EFFICIENCY OPPORTUNITIES SAVINGS AND COSTS (CONTINUED)						
Description	Potential Energy Conserved	Demand Savings (kW)	Potential Savings (\$/yr)	Implem. Cost (\$)	Simple Payback (years)	
11 Increase Evaporative Condenser Capacity of Cold Storage Refrigeration System	309,427 kWh/yr	35.32	29,637	38,468	1.3	
12 Use Ammonia Subcooling in Cold Storage Refrigeration System	585,108 kWh/yr	66.79	56,041	54,625	1.0	
13 Install Adjustable Speed Drives on Blowers in Vegetable Building IQF Freezers	42,087 kWh/yr	11.13	304,929	84,525	0.3	
Totals	(Electricity)	1,508,095 kWh/yr	200.61 kW*	\$488,163/yr	\$314,132	0.6 years
	(Natural Gas)	9,443 therms/yr				

¹ Summer Peak Demand Savings

* Maximum Demand Savings, excludes Measure No. 1.

Implemented Measures

In following up with the plant half a year after submitting the report, the plant had already implemented or was in the planning stages of implementing all of the recommended energy efficiency measures. Some of the measures that the plant has already implemented are included as follows:

Measure 1 – Shift Cold Storage Ammonia Compressors to Off-Peak During Summer

The facility utilizes a two-stage ammonia refrigeration system to provide cooling for their Cold Storage rooms and blast tunnel freezers. The current practice is to run the both high and low stage ammonia compressors throughout the day to maintain a relatively constant temperature (0 °F to 5 °F) in the Cold Storage room. Based on previous experience at other facilities with cold storage and a study performed by the University of Wisconsin on refrigerated warehouses, a portion of the refrigeration equipment can remain idle during On-Peak periods with minimal changes in the Cold Storage room and product temperature. Thus, it is possible to turn off some of the ammonia compressors during the On-Peak time period in the summer season and operate all of the compressors during the Off-Peak time period resulting in an electrical cost savings of over \$31,000 per year.

Measure 11 – Increase Evaporative Condenser Capacity of Cold Storage Refrigeration System

It was recommended to increase the condensing capacity of the Cold Storage refrigeration system by installing more evaporative condensers. Installing additional condensing capacity will lower the system head pressure, which will reduce the power consumption of the ammonia compressors. Increasing the evaporative condensing capacity of the Cold Storage refrigeration system in order to reduce the system discharge pressure would result in an estimated electrical energy savings of 309,000 kWh per year and a demand reduction of over 35 kW.

Measure 12 – Use Ammonia Subcooling in Cold Storage Refrigeration System

Currently the facility utilizes a 2-stage ammonia refrigeration system to provide cooling to the Cold Storage rooms and Blast Freezer Tunnels. It was recommended to subcool the high-pressure ammonia in the cold storage refrigeration system before it flows to the evaporators. Subcooling increases the refrigeration capacity of the system, which reduces the power consumption of the cold storage ammonia refrigeration system. The electrical energy savings for subcooling the warmer, high-pressure liquid ammonia is estimated to be over 585,000 kWh/yr, with a demand reduction of over 66 kW.