Case Study: Engine-Driven Refrigeration – Omstead Foods
Location: Ontario, Canada

Food Processor Harvests Dual Savings with Natural Gas

The Omstead Foods plant employs two natural gas-fueled Caterpillar engines to drive ammonia compressors for freezing and refrigeration. Both engines are direct-drive to the compressors, eliminating the cost and maintenance of gear costs.

Omstead Foods, located on the north shore of Lake Erie, processes more than 100 million pounds of frozen foods annually, primarily for commercial markets. In addition to flash freezing, the Ontario plant maintains 5,000,000 cubic feet of year-round storage at -10^{o}F.

Until 1995, the company relied on 27 electric-powered reciprocating and screw compressors for its freezing and refrigeration needs; total electric motor capacity exceeded 4600 horsepower. When the company sought expansion of its freezing capacity by 350 tons, the electric utility said that a new, larger substation was required--at a cost of U.S. $550,000 charged to Omstead.

Steve Williams, chief engineer of the Omstead plant at the time, began looking for an alternate solution. Conferring with Ted Martin, director of engineering at CIMCO Refrigeration in Toronto, Williams discovered that shifting the load from electric power to natural gas would not only save the expense of a new substation, but also generate significant savings in annual energy costs.

"The lights really went on when we looked at heat recovery," explains Martin. "We proposed harnessing heat from the cooling jackets, exhaust systems and oil coolers of natural gas-powered Caterpillar engines, and using it to produce hot water and steam for processing needs. In fact, we calculated the company could eliminate one of their existing boilers this way."

CIMCO recommended two ammonia screw compressors to meet Omstead's needs: a 200 HP/227 TR booster compressor operating at -35dF, driven by a Caterpillar G3406NA engine; and a 675 HP/534 TR high-stage compressor operating at +10dF, driven by a Caterpillar G3412TA engine. Both engines have 115-psi steam boilers on the engine exhaust, plus heat reclaim exchangers on the jacket water and oil coolers.

To dump waste heat when a heating load is unavailable, Omstead employs rooftop exchangers for the water jacket system, and an exhaust diverter valve to allow 100 percent bypass of gases around the steam boilers.

The two natural gas engines provide base-load compressor needs for the plant, with others added according to the plant's needs.

Total heat output from both engines is estimated at 8,000,000 Btu/hr.; Omstead management estimates an annual fuel saving of $92,000 from the reclaimed heat.

In addition to savings in energy costs and substation construction, Omstead and CIMCO applied another money-saving concept. By choosing larger-than-specified screw compressors--which run at a lower RPM than those originally specified--the firm eliminated the need for a gearing system to raise the speed of the compressors. Instead, the engines run direct-drive at maximum RPM,

providing substantial capital cost and maintenance expense savings associated with gearing systems.

Allowing for an annual $42,000 annual engine maintenance contract, Omstead management calculates annual savings of $57,500, in addition to eliminating the $750,000 cost of a new substation if the firm had remained exclusively electrical.

Almost three years following the installation, Ted Martin is still impressed with the Omstead system. "When you stop to think about it, the system is really amazing. We feed natural gas into it, and we get minus 40 degrees temperature at one end and steam from the other. The steam cooks the product, and the cold air freezes it instantly, all from the same source. How's that for energy efficiency?"