Evaluating the Gas-Driven Air Compressor Alternative

Compressed air is essential in many manufacturing plants, and it is not unusual for 30% of a plant's electric utility costs to go toward the production of compressed air. The annual electricity cost to operate an electric air compressor can equal or exceed the first cost of the unit.

Natural gas engine-driven air compressors (NGEDAC) greatly reduce power demand and energy consumption costs. Many manufacturing plants, in both private and government sectors, are benefiting from the attractive economics and reliable operation provided by these natural gas systems.

For instance, when the U.S. Army wanted to upgrade their facilities with more efficient and cost-effective equipment, they looked to the NGEDAC technology as an important part of their strategy. Their project team conducted preliminary site assessments at six facilities. What were the results? "This program established the viability of applying NGEDAC technology at a number of DOD industrial facilities. ... All Army industrial installations will be screened for [the NGEDAC] technology application."

Technology Basics and Benefits

Compressors may be driven by almost any prime mover: a motor, steam turbine, combustion turbine, or internal combustion engine. Historically, electric motors have dominated the market, but natural gas engines have recently gained popularity as an alternative.

In a large, stationary air-compressor application, the prime mover, for the most part, is independent of the rest of the compressor equipment. Whether natural gas or electrically powered, the compressor unit itself is usually of the rotary-screw type. Fig. 1 shows the components of a typical installation.

Rotary screw compressors are positive displacement devices, so their output pressure tends to be independent of speed. In NGEDAC installations, it is possible to vary the engine speed to track the plant's airflow demand. This provides a significant advantage over electric-motor drives where the motor/compressor speed is fixed. To vary the output flow rate, electric-motor installations must use a throttle valve on the compressor's inlet. Thus, the installation's part load efficiency overall can be much higher with a natural-gas drive than with an electric motor drive.

Most users consider natural gas to be a more reliable energy source than electricity to power air compressors. While electricity is notorious for weather-induced disruptions as well as blackouts and brownouts due to grid overload, natural-gas delivery systems are usually less subject to interruptions than the electric supply.

Natural gas is also resource efficient and environmentally friendly on a global basis when compared to other means of powering air compressors. Unlike electric power, which is generally produced at a centrally located electric utility, gas engines produce their mechanical energy locally. Thus, their overall energy efficiency tends to be higher when you include losses in the electricity distribution system in the calculation.

Compared to diesel power, natural gas burns very cleanly. Gas engines come much closer to producing the ideal exhaust-gas mixture containing only water vapor and carbon dioxide. Nitrous oxide emissions can be controlled to very low levels and, in addition, natural gas contains little or no pollutant-producing contaminants or additives.

Economic Returns

Customers choose natural gas-powered units to take advantage of reduced energy costs and improved reliability associated with the technology. Gas engine drives also produce heat, which can be recovered for other purposes. Fig. 2 indicates these various opportunities for heat recovery. "You've got multiple sources of heat," points out Robert Eck, Area Manager in Buffalo, New York for gas distributor National Fuel, "from the lube oil cooler, engine jacket water, and the exhaust, which can be used to produce hot water or low-grade, low-pressure steam. You can use this essentially free energy to displace some other form of energy in the plant."

According to Eck, "NGEDAC equipment generally costs more than equivalent electrically pow-

AT A GLANCE
Gas-driven air compressors

- Provide lower operating costs
- Conserve energy
- Can qualify for some energy conservation grants

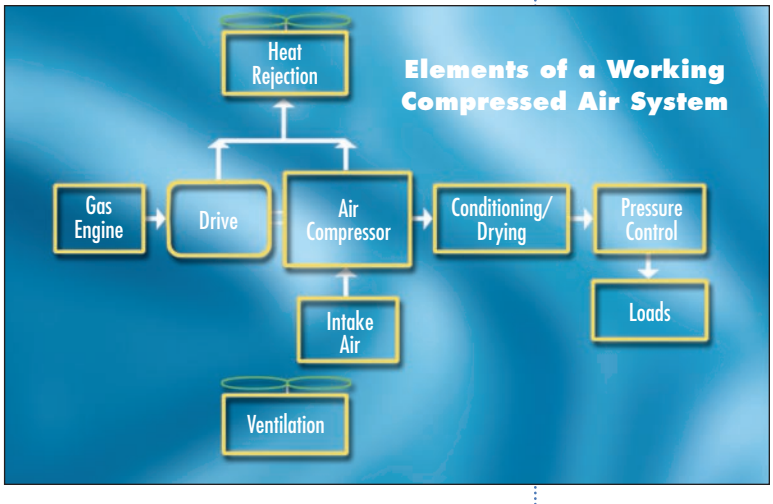

Fig. 1: The elements of a gas-driven air compressor installation are very similar to those components in an electrically driven air compressor. Energy Solutions Center, Washington, D.C.

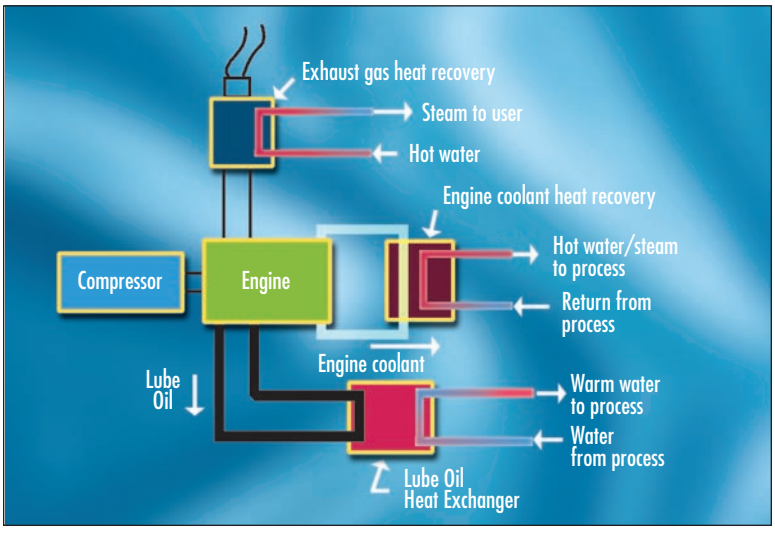

Fig. 2: NGEDAC installations open up opportunities for additional energy-cost savings through recovery of heat rejected by various parts of the engine. Energy Solutions Center, Washington, D.C.

ered equipment, and requires more labor to install and maintain. However, since the energy cost for operating NGEDAC tends to be lower than those for electrically powered compressors, it sets up a tradeoff between capital and operating expenses that can be determined by a payback analysis.

An initial screening analysis takes into consideration the capital and operating costs, estimated savings, and considers both potential electric savings and thermal savings from heat recovery. The next step is to bring in the equipment vendors to help determine exactly what the total installed cost would be, what type equipment would be needed, and any financing options. The result is a detailed payback analysis.

A large northeastern private-label jarred-foods producer recently converted their compressed air plant to natural gas to drive packaging equipment, actuators and control systems after just such an evaluation.

This customer brought in the engineering firm of Siemens Building Technology, headquartered in Amherst, N.Y. to study their energy usage and evaluate possible gas-energized options. Siemens looked at all the energy-consuming components of the food processor's operation, including refrigeration needs, cogeneration opportunities and air compression. In the end, they recommended installing two gas-fueled air compressors (a 250 HP unit and a 100 HP unit) and a 250 T gas-fueled chiller.

Siemens provided a total financing package for the food processor that included guaranteed savings and no up-front cost. Essentially, Siemens designed, built and installed the new equipment, and leased it to the manufacturing company. At the end of the contract lease period, the company has the option of purchasing the installed gas-fired equipment and can then continue to reap the cost saving benefits from this integrated NGEDAC installation.

Some customers utilize hybrid systems that deploy both motor and engine driven units, The ability to operate either on natural gas or electricity allows greater operating flexibility and control to address rapid spikes in fuel prices or electric curtailments and to manage compressor equipment shutdowns and maintenance expenses. In a typical installation, a gas-driven compressor operates at full capacity during on-peak hours of operation, while an electrically driven machine picks up the remainder of the load. During mid- and off-peak periods, this situation is reversed. In this way, the hybrid installation minimizes energy cost by always using the least expensive energy source at the time. It also provides a much higher overall compressed air reliability for the plant operator.

As many industrial customers and government groups have come to realize, NGEDAC technology installations provide the energy savings and flexibility needed to be competitive and productive in today's business environment.

For more information:

Visit the Energy Solutions Center's Air Compressor Consortium website at www.aircompressor.org, or contact your local gas distributor.

National Fuel
Buffalo, N.Y.
www.natfuel.com

Industries Using Gas-Powered Air Compressors

A variety of manufacturing facilities across the US already benefiting from the economic and reliable operations of natural gas engine-driven air compressors includes, but is not limited to the following industries:

- Automobile parts
- Baking
- Coating and plating
- Dairy
- Food processing
- Heat treating
- Plastics manufacturing

Gas-Powered Air Compressor Manufacturers

Dearing Compressors & Pumps
3974 Simon Rd., Youngstown, OH 44501
Phone: 330-783-2258 Fax: 330-783-0762

Gascom
2045 South Valentia No.19, Denver, CO 80231
Phone: 303-368-5888 Fax: 303-368-5108

GrimmerSchmidt Compressors
1015 N. Hurricane Rd., Franklin, IN 46131
Phone: 317-736-3800 Fax: 317-736-3801

Ingersoll-Rand Company
819 Woodgrove Rd., Fillmore, CA 93015
Phone: 805-524-7808 Fax: 805-524-7812