

FACT SHEET

COMPRESSED AIR

Seventy percent of all manufacturing facilities in the United States use compressed air to drive a variety of equipment. However, a recent survey by the U.S. Department of Energy (DOE) noted that 57 percent of manufacturing plants made no improvements in compressed air system efficiency in the two years preceding the survey. Seventy-six percent of the cost of compressed air is electricity, so energy savings can have a significant effect on the bottom line.

The table from the DOE survey (below) shows that more than half of industrial plant air systems have opportunities for large energy savings. Some of these opportunities require an investment. To help you make the upgrade and achieve the energy savings, ComEd's *Smart Ideas for Your Business*SM program offers custom incentives of \$0.03 to \$0.07 per kWh saved.

Measure	Potential Energy Savings
Reduce overall system requirements	20%
Match compressor size to load	3%
Improve compressor controls	10%
Improve compressor components	5%
Operation and maintenance	10%

Achieving the lowest possible energy consumption involves meeting operational demand at the lowest possible pressure, supporting transient events as much as possible with stored air and taking as long as possible to replenish storage.

REDUCE OVERALL SYSTEM REQUIREMENTS

Compressed air generation is one of the most expensive activities in an industrial facility. The typical system consists of multiple compressors delivering air to a common plant air header. The combined capacity of the compressors is sized to meet the plant's maximum air demand.

To reduce overall energy consumption, identify all compressed air uses and the flow and pressure requirements of each use. Consider other cost-effective forms of power to eliminate unproductive demands — that is, any application that can be done more effectively or efficiently by a method other than compressed air.

Properly designed compressed air storage can allow a compressed air system to meet its peak demand needs while minimizing compressor use and pressure. By eliminating the peak demands that drop overall system pressure, storage helps protect critical end-use applications, prevents additional units from coming online, and makes air tools function more efficiently.

A variable speed drive (VSD) is ideal for trimming (matching pressure to demand). A compressor equipped with a VSD varies compressed air flow in response to detected changes in air system



A manufacturing plant in the Chicago area needed to control electricity costs — while ensuring that its compressed air system could deal with minute-by-minute demand fluctuations of several thousand scfm. Their air system operates 6,000 hours per year and includes 12 compressors in five areas of the plant.

The upgrade included an extensive reconfiguration of the piping plus the installation of microprocessor-based controls. The \$273,000 project is projected to save almost 3 million kWh per year and, with a \$136,345 incentive from ComEd's *Smart Ideas for Your Business* program, will pay for itself in less than a year.

pressure to maintain an exact and constant pressure level. As demand falls and more air is delivered into the air system, pressure will rise and the VSD will reduce the compressor's speed and output. An increase in compressed air demand causes system pressure to fall and the VSD to increase output. Variable speed drives may qualify for incentives from ComEd's *Smart Ideas for Your Business* program ranging from \$25 to \$50 per horsepower.

MATCH COMPRESSOR SIZE TO LOAD

Compressors are most efficient when they operate fully loaded. If a compressed air system is sized for peaks, the compressors are idle most of the time, which means they operate inefficiently and inflate energy demand. A modulating compressor operating at 40 percent output could still be consuming 80 percent of its full load power requirement. Every online compressor should be at full load, except the one unit in trimming mode (matching supply with demand).

IMPROVE COMPRESSOR CONTROLS

Compressed air system controls match the compressed air supply with system demand, and are one of the most important determinants of system energy efficiency and minimized energy consumption. The controls shut off unneeded compressors or delay bringing on additional compressors until needed. System controls are almost always needed to orchestrate the reduction in output of individual compressors during lower-demand time periods. The type of controls needed for a system depends on the type of compressor and the facility's demand profile.

Simple controls may be appropriate for small compressed air systems, but larger systems will be more efficient with more sophisticated microprocessor-based sequencer controls and network controls that can keep system pressure within tighter control ranges. Narrower pressure variations save energy (1 percent per 2 psi) and avoid negative effects on production quality. Data-linking a VSD to a controller produces the highest efficiency gains.

IMPROVE COMPRESSOR COMPONENTS

National Electrical Manufacturers Association (NEMA) premium-efficiency motors are a quick and easy upgrade for compressors – and may qualify for incentives ranging from \$7 for a 1-HP motor to \$450 for a 200-HP motor from ComEd's *Smart Ideas for Your Business* program. See the *Smart Ideas: Motors* fact sheet for more information about these incentives.

CALCULATING ENERGY COSTS

Calculating energy use for compressed air systems is complex. The DOE's AIRMaster+ provides comprehensive information on assessing compressed air systems, including modeling, existing and future system upgrades, and evaluating savings and effectiveness of energy efficiency measures. It can be found on the DOE Web site at http://www1.eere.energy.gov/industry/bestpractices/software_airmaster.html.

To find the annual cost of electricity used to power a compressed air system, calculate the cost for running the system under loaded and unloaded conditions. For each, multiply the compressor horsepower by .746 to convert it to kW, then multiply by the total operating hours per year, the typical percentage of full-load HP and the percentage of time the compressor runs at that load. Divide the product by the motor's efficiency:

$$\begin{array}{l} \text{System HP} \\ \times 0.746 \text{ (convert to kW)} \\ \times \text{hours of use per year} \\ \times \% \text{ full-load hp} \\ \times \% \text{ time at level} \div \text{motor efficiency} \\ \hline \text{kWh per year} \end{array}$$

Multiply the kWh per year by your kWh rate for your annual energy cost.

CONTACT US

For more information about ComEd's *Smart Ideas for Your Business* visit www.ComEd.com/BizIncentives or call 888-806-2273.

