Determine the Cost of Compressed Air for Your Plant

Most industrial facilities need some form of compressed air, whether for running a simple air tool or for more complicated tasks such as operation of pneumatic controls. A recent survey by the U.S. Department of Energy showed that for a typical industrial facility, approximately 10% of the electricity consumed is for generating compressed air. For some facilities, compressed air generation may account for 30% or more of the electricity consumed. Compressed air is an on-site generated utility. Very often the cost of generation is not known; however, some companies use a value of 15-30 cents per 1000 cubic feet of air.

Compressed air is one of the most expensive sources of energy in a plant. The overall efficiency of a typical compressed air system can be as low as 10-15%. For example, to operate a 1 hp air motor at 100 psig, approximately 7-8 hp of electrical power is supplied to the air compressor.

To calculate the cost of compressed air in your facility, use the formula shown below:

$$\text{Cost (\$)} = \frac{\text{(bhp) x (0.746) x (\# of operating hours) x (\$/kWh) x (\% time) x (\% full load bhp)}}{\text{Motor Efficiency}}$$

where bhp—Compressor shaft horsepower (frequently higher than the motor nameplate horsepower—check equipment specification)

Percent time—percentage of time running at this operating level

Percent full-load bhp—bhp as percentage of full-load bhp at this operating level

Motor efficiency—motor efficiency at this operating level

Example

A typical manufacturing facility has a 200 hp compressor (which requires 215 bhp) that operates for 6800 hours annually. It is fully loaded 85% of the time (motor efficiency = 95%) and unloaded the rest of the time (25% full-load bhp and motor efficiency = 90%). The aggregate electric rate is $0.05/kWh.

Cost when fully loaded =

$$\frac{\text{(215 bhp) x (0.746) x (6800 hrs) x (\$0.05/kWh) x (0.85) x (1.0)}}{0.95} = \textbf{\$48,792}$$

Cost when partially loaded =

$$\frac{\text{(215 bhp) x (0.746) x (6800 hrs) x (\$0.05/kWh) x (0.15) x (0.25)}}{0.90} = \textbf{\$2,272}$$

Annual energy cost = $48,792 + $2,272 = **$51,064**

Suggested Actions

- Determine the cost of compressed air for your plant by periodically monitoring the compressor operating hours and load duty cycle.
- Use a systems approach while operating and maintaining a compressed air system.
- Adopt a plant-wide compressed air management policy to cut costs and reduce waste by eliminating inappropriate uses, fixing leaks, and matching system supply with demand.

References

Improving Compressed Air System Performance: A Sourcebook for the Industry, Motor Challenge and Compressed Air Challenge, April 1998.

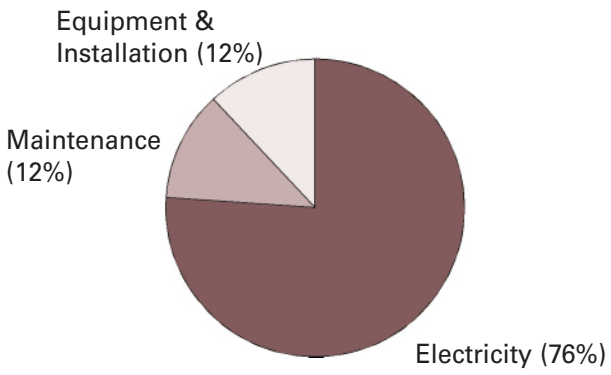
Training

- *Fundamentals of Compressed Air Systems* - 1 day
- *Advanced Management of Compressed Air Systems* - 2 days

Offered by the Compressed Air Challenge. Call the OIT Clearinghouse or visit the BestPractices Web site (www.oit.doe.gov/bestpractices) for the latest schedule and locations.

For additional information on industrial energy efficiency measures, contact the OIT Clearinghouse at (800) 862-2086.

Typical Lifetime Compressed Air Costs in Perspective*



* Assumptions in this example include a 75 hp compressor operated 2 shifts a day, 5 days a week at an aggregrate electric rate of $0.05/kWh over 10 years of equipment life.

About DOE's Office of Industrial Technologies

The Office of Industrial Technologies (OIT), through partnerships with industry, government, and non-governmental organizations, develops and delivers advanced energy efficiency, renewable energy, and pollution prevention technologies for industrial applications. OIT is part of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

OIT encourages industry-wide efforts to boost resource productivity through a strategy called Industries of the Future (IOF). IOF focuses on the following nine energy and resource intensive industries:

- Agriculture
- Aluminum
- Chemicals
- Forest Products
- Glass
- Metal Casting
- Mining
- Petroleum
- Steel

OIT and its BestPractices program offer a wide variety of resources to industrial partners that cover motor, steam, compressed air and process heating systems. For example, BestPractices software can help you decide whether to replace or rewind motors (MotorMaster+), assess the efficiency of pumping systems (PSAT), or determine optimal insulation thickness for pipes and pressure vessels (3E Plus). Training is available to help you or your staff learn how to use these software programs and learn more about industrial systems. Workshops are held around the country on topics such as "Capturing the Value of Steam Efficiency," "Fundamentals and Advanced Management of Compressed Air Systems," and "Motor System Management." Available technical publications range from case studies and tip sheets to sourcebooks and market assessments. The *Energy Matters* newsletter, for example, provides timely articles and information on comprehensive energy systems for industry. You can access these resources and more by visiting the BestPractices Web site at **www.oit.doe.gov/bestpractices** or by contacting the OIT Clearinghouse at **800-862-2086** or via email at **clearinghouse@ee.doe.gov.**

BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices focuses on plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small and medium-size manufacturers.

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Eric Lightner
Office of Industrial Technologies
Phone: (202) 586-8130
Fax: (202) 586-1658
Eric.Lightner@ee.doe.gov
www.oit.doe.gov/bestpractices

OIT Clearinghouse
Phone: (800) 862-2086
Fax: (360) 586-8303
clearinghouse@ee.doe.gov

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Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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